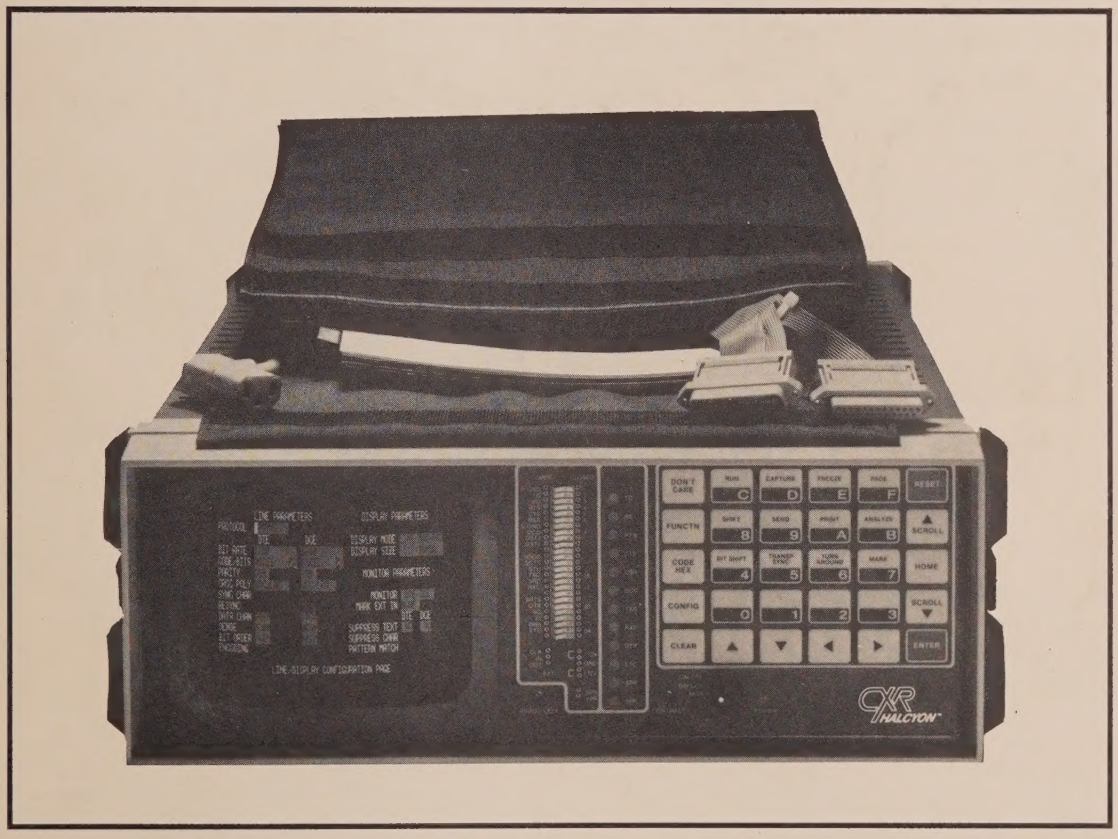
**OPERATION MANUAL**

**MAY, 1986**

# MODEL 801B
# DATA LINK MONITOR

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# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| 1 | GENERAL | |
| 1.1 | INTRODUCTION - HOW TO USE THIS MANUAL | 1-1 |
| 1.2 | PURPORSE AND DESCRIPTION | 1-2 |
| 1.3 | CONVENTIONS | 1-2 |
| 2 | OVERVIEW OF SYSTEM OPERATION | |
| 2.1 | GENERAL | 2-1 |
| 2.2 | DUST COVER | 2-1 |
| 2.3 | FRONT PANEL | 2-1 |
| | Video Display | 2-1 |
| | Line Interface/Breakout Box | 2-1 |
| | Keypad | 2-1 |
| 2.4 | REAR PANEL - CONNECTING THE 801B | 2-5 |
| | Power | 2-5 |
| | EIA Line Interface (RS-232-C Connector) | 2-5 |
| | Current Look Interface | 2-6 |
| | Video Outputs | 2-7 |
| | Adjusting the CRT for 50 or 60Hz Operation | 2-7 |
| | Rack Mounting | 2-7 |
| 2.5 | BATTERY PACK - DATA SAVER | 2-8 |
| | Hardware Reset vs. Software Reset | 2-8 |
| | Changing the Battery | 2-8 |
| 3 | BASIC OPERATING INSTRUCTIONS | |
| 3.1 | GENERAL | 3-1 |
| 3.2 | OVERVIEW OF OPRATION | 3-1 |
| | Initializing | 3-1 |
| | Overview of the Pages | 3-2 |
| 3.3 | AUTOMONITOR MODE | 3-3 |
| | Determining Transmission Codes on Asynchronous Lines | 3-4 |
| | The Automonitor | 3-4 |
| 3.4 | RUN MODE | 3-6 |
| | Monitor Function | 3-6 |
| | Freeze | 3-7 |
| | Code/Hex | 3-7 |
| | Transparent Sync/Resync | 3-7 |
| | Turnaround Time | 3-7 |

# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| 3.4 | RUN MODE (cont.) | |
| | Mark | 3-8 |
| | Transmission Code Selection | 3-8 |
| | Capture | 3-8 |
| 3.5 | CAPTURE MODE | 3-9 |
| | Code/Hex | 3-9 |
| | Scroll | 3-9 |
| | Cursor | 3-10 |
| | Bit Shift | 3-11 |
| | Reset | 3-11 |
| 3.6 | PAGE 1 - LINE/DISPLAY PAGE | 3-12 |
| | PROTOCOL Field | 3-13 |
| | BIT RATE Field | 3-13 |
| | CODE/BITS Field | 3-14 |
| | PARITY Field | 3-14 |
| | CRCC POLYnomial Field | 3-14 |
| | The "Data Entry" Fields | 3-14 |
| | SYNC CHARacter Field | 3-15 |
| | RESYNC Field | 3-16 |
| | DATA CHANnel | 3-16 |
| | Data SENSE Field | 3-16 |
| | Data BIT ORDER Field | 3-16 |
| | Data ENCODING Field | 3-16 |
| | The LINE CONFIGURATION Parameters | 3-17 |
| | DISPLAY MODE Field | 3-18 |
| | DISPLAY SIZE Field | 3-18 |
| | MONITOR Field | 3-19 |
| | MARK EXTernal INput Field | 3-19 |
| | SUPPRESS TEXT Field | 3-19 |
| | SUPPRESS CHARacters Field | 3-20 |
| | PATTERN MATCH Field | 3-20 |
| | CONFIGuration Key | 3-20 |
| 3.7 | PAGE 2 -- START/STOP PAGE / PAGE 3 -- COUNTER PAGE | 3-21 |
| | Overview of the Start/Stop Function | 3-21 |
| | FUNCTION Field | 3-21 |
| | Start/Stop Triggers - Overview | 3-22 |
| | EXTernal INputs Field | 3-22 |
| | START STRINGS / STOP STRINGS Fields | 3-23 |
| | OR/IND Field | 3-23 |
| | The "Pre-Trigger" | 3-23 |
| | Trigger Strings | 3-24 |
| | Stop Trigger Function | 3-26 |
| | ERROR ALARM Field | 3-26 |
| | PAGE 3: System Counters | 3-26 |

# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| 3.7 | PAGE 2 - START/STOP PAGE/PAGE 3 - COUNTER PAGE (cont.) | |
| | Enabling/Disabling the Counters | 3-27 |
| | STOP ON ERROR Field | 3-27 |
| | TRIGGER COUNT Field | 3-28 |
| | POST-TRIGger COUNT Field | 3-28 |
| | TIMEOUT VALUE Field | 3-28 |
| 3.8 | OTHER START-STOP FUNCTIONS | 3-32 |
| | Timeout-stop Function | 3-32 |
| | Elapsed Seconds or Milliseconds | 3-32 |
| | Elapsed Character Function | 3-34 |
| 3.9 | SELF-TESTS | 3-35 |
| | Automatic Self-Tests | 3-35 |
| | Self-Test Mode | 3-35 |
| | Test #1 - REVISION REPORT | 3-35 |
| | Test #2 - PROCESSOR TIMER TEST | 3-35 |
| | Test #3 - SYSTEM RAM | 3-36 |
| | Test #4 - LOOPBACK TEST | 3-36 |
| | Test #5 - VIDEO RAM | 3-36 |
| | Test #6 - WRITE/READ RAM LOOP | 3-36 |
| | Test #7 - KEYPAD/VIDEO DISPLAY | 3-36 |
| 4 | PRINTER / POLL / BIT-ERROR-RATE TEST | |
| 4.1 | GENERAL | 4-1 |
| 4.2 | THEORY OF OPEARATION | 4-2 |
| | Interconnection | 4-2 |
| | Printer/Poll/BERT-II Functions | 4-2 |
| 4.3 | BERT (BIT ERROR RATE TEST) FUNCTION | 4-4 |
| 4.4 | PRINTER FUNCTION | 4-5 |
| | Print Format | 4-6 |
| 4.5 | POLL FUNCTION - GENERAL | 4-8 |
| 4.6 | INSTRUCTIONS - POLLING | 4-9 |
| | Initial Setup | 4-9 |
| | Loading a Default or Stored Program | 4-9 |
| | Manually Editing or Entering a Program | 4-10 |
| | Storing the Program | 4-10 |
| | Running the Program | 4-11 |
| | Missing EIA Signals | 4-11 |
| 4.7 | PPB COMMANDS, OPERANDS, AND "NEXT" STATEMENTS | 4-12 |
| 4.8 | EXAMPLES OF POLLING PROGRAMS | 4-14 |

# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| 5 | X.25 PROTOCOL ANALYSIS | |
| 5.1 | RATIONAL | 5-1 |
| 5.2 | GENERAL | 5-1 |
| 5.3 | OPERATING INSTRUCTIONS | 5-2 |
| | Line Monitoring | 5-2 |
| | Analysis | 5-2 |
| 6 | DDCMP ANALYSIS | |
| 6.1 | GENERAL | 6-1 |
| 6.2 | OPERATING INSTRUCTIONS | 6-1 |
| | Line Monitoring | 6-1 |
| | Analysis | 6-2 |
| | DDCMP Analysis - Background | 6-3 |
| 7 | SNA PROTOCOL ANALYSIS | |
| 7.1 | GENERAL | 7-1 |
| 7.2 | OPERATING INSTRUCTIONS | 7-1 |
| | Line Monitoring | 7-1 |
| | Analysis | 7-1 |
| 7.3 | DISPLAY FORMAT | 7-3 |
| APPENDICES | | |
| A | SPECIFICATIONS. ACCESSORIES. | |
| A.1 | SPECIFICATIONS | A-1 |
| A.2 | OPTIONS AND ACCESSORIES | A-3 |
| B | ERROR CODES | B-1 |
| C | TRANSMISSION CODE DESCRIPTIONS | C-1 |
| D | X.25 PROTOCOL ANALYSIS | D-1 |
| D.1 | GENERAL | D-1 |
| D.2 | PHYSICAL LEVEL | D-1 |
| D.3 | FRAME LEVEL | D-1 |
| | Receive Ready (RR) Command/Response | D-4 |
| | Receive Not Ready (RNR) Command/Response | D-4 |
| | Reject (REJ) Command/Response | D-4 |
| | Set Asynchronous Response Mode (SARM) Command | D-4 |
| | Set Asynchronous Balanced Mode (SABM) Command | D-5 |

# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| D.3 | FRAME LEVEL (cont.) | |
| | Disconnect (DISC) Command | D-5 |
| | Unnumbered Acknowledge (UA) Response | D-5 |
| | Disconnected Mode (DM) Response | D-5 |
| | Command Reject (CMDR) Response | D-5 |
| | Frame Reject (FRMR) Response | D-5 |
| | Information (I) Command | D-6 |
| | Frame Check Sequence Field | D-6 |
| D.4 | PACKET LEVEL | D-7 |
| | Call Request / Incoming Call | D-10 |
| | Call Accepted / Call Connected | D-10 |
| | Clear Request / Clear Indication | D-11 |
| | DTE and DCE Clear Confirmations | D-13 |
| | DTE and DCE Data Packets | D-13 |
| | DTE and DCE Interrupt | D-13 |
| | DTE and DCE Interrupt Confirmation | D-14 |
| | DTE and DCE Receive Ready (RR) | D-14 |
| | DTE and DCE Receive not Ready (RNR) | D-15 |
| | DTE Reject (REJ) | D-15 |
| | Reset Request / Reset Indication | D-15 |
| | DTE and DCE Reset Confirmation | D-16 |
| | Restart Request and Restart Indication | D-16 |
| | DTE and DCE Restart Confirmation | D-17 |
| | DCE Diagnostic | D-17 |
| E | DEFAULT POLLING PROGRAMS | |
| E.1 | GENERAL | E-1 |
| E.2 | ASYNC PROTOCOL | E-1 |
| | ASYNC Menu Selection #1. Printer Test Program | E-1 |
| E.3 | SYNC PROTOCOL | E-2 |
| | SYNC 3270 Menu Selection #2. Poll | E-2 |
| | SYNC 3270 Menu Selection #3. Respond to Poll | E-3 |
| | SYNC 3270 Menu Selection #4. Select Display | E-3 |
| | SYNC 3270 Menu Selection #5. Select Printer | E-4 |
| | SYNC X.25 Menu Selections | E-5 |
| E.4 | IPARS PROTOCOL | E-5 |
| | IPARS Menu Selection #1. Poll w/Response | E-5 |
| | IPARS Menu Selection #2. Respond to Poll | E-6 |
| | IPARS Menu Selection #3. Output Message | E-6 |

# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| E.5 | SDLC PROTOCOL | E-7 |
| | SDLC Menu Selection #1. Poll | E-7 |
| | SDLC Menu Selection #2. Respond to Poll | E-8 |
| E.6 | HDLC PROTOCOL | E-8 |
| | HDLC Menu Selection #1. LAPB - SIM DTE | E-9 |
| | HDLC Menu Selection #2. LAPB - SIM DCE | E-10 |
| | HDLC Menu Selection #3. LAP - SIM DTE | E-10 |
| | HDLC Menu Selection #4. LAP - SIM DCE | E-11 |
| F | RS-232-C INTERFACE | F-1 |
| R | RAMpak$^{tm}$ | R-1 |

# TABLE OF CONTENTS


| SECTION FIGURES | DESCRIPTION | PAGE |
|---|---|---|
| 2-1 | Front Panel "Breakout Box" | 2-2 |
| 2-2 | Interfacing the 801B to Current Loop Circuits | 2-5 |
| 2-3 | 801B Video Connectors | 2-6 |
| 3-1 | The AUTOMONITOR Display | 3-3 |
| 3-2 | The DATA/STATUS Page | 3-6 |
| 3-3 | Time-multiplex Display Mode/Turnaround Time | 3-7 |
| 3-4 | PAGE 0, The DATA/STATUS Page (Capture Mode) | 3-9 |
| 3-5 | The LINE/DISPLAY Page | 3-12 |
| 3-6 | The ASYNC/SYNC START/STOP Page | 3-22 |
| 3-7 | HDLC/SDLC Start/Stop Page | 3-24 |
| 3-8 | The COUNTER Page | 3-26 |
| 3-9 | PAGE 0, Elapsed Time Function | 3-32 |
| 4-1 | Poll PROGRAM Page | 4-1 |
| 4-2 | The Poll MENU Page | 4-1 |
| 4-3 | Printer Page | 4-2 |
| 4-4 | BERT Page | 4-2 |
| 4-5 | Printer Output | 4-6 |
| 4-6 | Printer Test Program | 4-14 |
| 4-7 | SYNC 3270: Terminal Polling Program | 4-15 |
| 5-1 | Typical X.25 Display Format | 5-1 |
| 5-2 | X.25 Analysis Page | 5-2 |
| 6-1 | Typical DDCMP Analysis Display | 6-2 |
| 7-1 | Typical SNA Analysis Display | 7-2 |
| D-1 | X.25 Frame Formats | D-2 |
| D-2 | FRMR I-Field Format | D-6 |
| D-3 | Typical Packet Header Format | D-7 |
| D-4 | Call Request and Incoming Call Packet Format | D-10 |
| D-5 | Clear Request / Indication Packet Format | D-11 |
| D-6 | DTE and DCE Data Packet Format | D-13 |
| D-7 | DTE and DCE Interrupt Packet Format | D-14 |
| D-8 | DTE and DCE Interrupt Confirmation Packet Format | D-14 |
| D-9 | DTE and DCE Receive Ready Packet Format | D-15 |
| D-10 | Reset Request / Indication Packet Format | D-16 |
| D-11 | Restart Request / Indication Packet Format | D-17 |
| D-12 | DCE Diagnostic Packet Format | D-18 |

# TABLE OF CONTENTS


| SECTION TABLES | DESCRIPTION | PAGE |
|---|---|---|
| 4-1 | PPB Commands, Operands and NEXT Statements | 4-12 |
| 5-1 | X.25 Analysis Display Format | 5-3 |
| 6-1 | DDCMP Mnemonics | 6-4 |
| 7-1 | Alphabetical List of Mnemonics and Abbreviations | 7-5 |
| 7-2 | Error Messages | 7-7 |
| C-1 | Transmission Code Conversion Chart | C-3 |
| C-2 | Character to Transmission Code Conversion Chart | C-6 |
| D-1 | Control Field Formats | D-3 |
| D-2 | Packet-Type ID Codes | D-9 |
| D-3 | Clearing Cause Codes | D-11 |
| D-4 | Diagnostic Codes | D-12 |
| D-5 | Resetting Cause Codes | D-16 |
| D-6 | Restarting Cause Codes | D-17 |
| F-1 | EIA RS-232-C Interface Connector Pin Assignments | F-1 |
| F-2 | Interchange Logic States | F-2 |

# TABLE OF CONTENTS


| SECTION | DESCRIPTION | PAGE |
|---|---|---|
| APPLICATIONS | | |
| 2-1 | Connecting the 801B | 2-5 |
| 2-2 | Connecting the 801B to a Current Loop Interface | 2-6 |
| 3-1 | Introduction to Monitoring, Part 1 | 3-4 |
| 3-2 | Introduction to Monitoring, Part 2 | 3-17 |
| 3-3 | How to Select the Bit Rate | 3-17 |
| 3-4 | Marking Data when SQD Drops | 3-19 |
| 3-5 | Start/Stop Function: General | 3-29 |
| 3-6 | Capturing Data Transmissions Only | 3-30 |
| 3-7 | Monitoring Select Stations on a Multidrop Link | 3-30 |
| 3-8 | BOP Start/Stop Strings | 3-31 |
| 3-9 | Timeout-Stop | 3-32 |
| 3-10 | Measuring Response Time | 3-33 |
| 3-11 | Determining the Size of Data Blocks or Packets | 3-34 |

# SECTION 1 -- GENERAL

## 1.1 INTRODUCTION -- HOW TO USE THIS MANUAL

If you are a first-time 801B user, we suggest that you sit down with the instrument, a cup of coffee, and this manual. Make the keystrokes as you read this text. If you take time to do this, we can safely state that you'll soon become an accomplished 801B operator. Also, remember the credo: When all else fails, read the manual.

This manual is both an instruction manual and a reference manual. As a reference manual, it is logically organized by function, and contains an extensive INDEX to help you find information on a particular function or display.

As an instruction manual, it contains numerous Applications (each uniquely numbered and named). The applications cover such useful topics as measuring RTS/CTS delay, monitoring the secondary channel on an RS-232-C interface, and selective monitoring of one station on a multipoint SNA or X.25 link. Each application builds on the material presented immediately before. The applications are listed on a separate page in the Table of Contents. Thus, you can quickly learn to use the 801B by simply carrying out the instructions in each application.

This manual is organized as follows:

Section 1: Introduction. How to use this manual. General description of the 801B. Conventions.

Section 2: Front and rear panel controls, connectors, and indicators. Includes instructions for interconnecting the 801B to a link and other equipment.

Section 3: Monitoring.
- o The PAGE menus. How to make selections.
- o Setup modes (line configuration, monitor configuration, display configuration, and counters)
- o Selective monitoring (Start/Stop Triggers)
- o The Automonitor$^{tm}$ mode.

Section 4: Printer/Poll/BERT Operating Instructions.
- o Output captured data to a printer.
- o Perform Bit Error Rate Testing.
- o Program the 801B to poll, respond to poll in a variety of protocols.

| | |
|---|---|
| Sections 5-7: | X.25, DDCMP, and SNA protocol analysis. |
| Appendix A: | Specifications. Accessories. |
| Appendix B: | Error codes and remedies. |
| Appendix C: | Transmission code descriptions |
| Appendix D: | Overview of X.25 protocol analysis. |
| Appendix E: | Default polling programs. |
| Appendix F: | RS-232-C interface |

The manual ends with a complete index.

## 1.2 PURPOSE AND DESCRIPTION

The CXR Telcom 801B Data Link Monitor combines sophisticated testing capabilities with simple operation for monitoring communications data links.

Its Automonitor$^{tm}$ feature can automatically determine bit rate, protocol, bits per character, and parity. Powerful start/stop trapping capability can be programmed to allow for selective monitoring and troubleshooting.

The 801B monitors all standard asynchronous and synchronous byte-controlled and bit oriented protocols at speeds up to 64 kbps, full duplex.

Twelve tri-state LEDs display the status of the significant leads on the RS-232-C interface. It contains a built-in current loop interface which operates at 20, 40, or 60mA; the transmit and receive leads can be set to active or passive.

With its Printer/Poll/BERT capability, the 801B is a powerful interactive testing device. It provides 1) printer output for hard copies of capture buffer data and programs, 2) polling capability for multi-step interaction with polled devices or for testing non-interactive devices such as printers or displays, and 3) bit error rate testing (BERT) capability.

The 801B is equipped to monitor, poll, and analyze X.25, DDCMP, and SNA protocols.

## 1.3 CONVENTIONS

Bytes in a data transmission are often referred to by their ASCII or EBCDIC names, such as <ETX>--End of Text or <NAK>--Negative Acknowledgement. The byte names may be descriptive, as in <BCC>--Block Check Character or <FCS>--Frame Check Sequence.

Hexadecimal numbers are preceded by a colon. :0A is decimal 13, "carriage return" (also referred to as <CR>); :1F is Decimal 127; "delete" (also referred to as <DEL>). A two-byte number in hexadecimal is presented in four hex digits: :2020.

# SECTION 2 -- OVERVIEW OF SYSTEM OPERATION

## 2.1 GENERAL

This section discusses the 801B's front and rear panels, and concludes with instructions on connecting the 801B to the communication link to be tested.

Detailed operating instructions are given in section 3; printer, poll, and BERT operation is described in section 4.

## 2.2 DUST COVER

The dust cover protects the CRT monitor, and contains a pocket to hold the jacks for the breakout box.

## 2.3 FRONT PANEL

For the purpose of this discussion, we may divide the front panel into three sections: a keypad, a breakout box with selected line indicators, and a CRT display. The front panel keys lie under a plastic membrane; the 801B beeps to let you know when you press a key. (It beeps twice when you press the wrong key--and sometimes prints an error message--see Appendix B.)

### Video Display

The 801B is equipped with a 5-inch (diagonal) amber CRT display. Brightness and contrast are adjusted by means of the screwdriver potentiometers recessed in the front panel. A digital RGB output and a B&W composite video output are provided (on the rear panel, described in Sec. 2.5, below).

### Line Interface/Breakout Box

The breakout box is wired in series with the rear-panel EIA connector. Consider the 801B to be connected to the right side of the breakout box. For normal monitoring applications, the switches should be "closed." Ten tri-state LEDs indicate the current status of the most commonly used lines; the LEDs are labeled. They turn red to indicate "mark" (-12V), green for "space" (+12V), and off (inactive line). The LEDs appear amber when rapidly changing between mark and space, as on the TxD or RxD leads while data are being transmitted, or on TxC or RxC (synchronous protocols).

To determine the status of other lines, connect the line of interest to either of the two spares (labeled SPR).

The rotary switch configures the EIA connector to SIMulate DTE or DCE. The switch is placed in the SIM position during PPB operations only (see section 4). When monitoring a link, leave the switch in the MON position.

EXTernal I/O Jacks

CLK: External input; acts as stop trigger or external data clock.

IN: External input; provides start trigger or highlights (marks) data in capture buffer.

OUT: Goes to mark (-12V) condition on occurrence of start trigger; returns to space (+12V) on stop trigger.

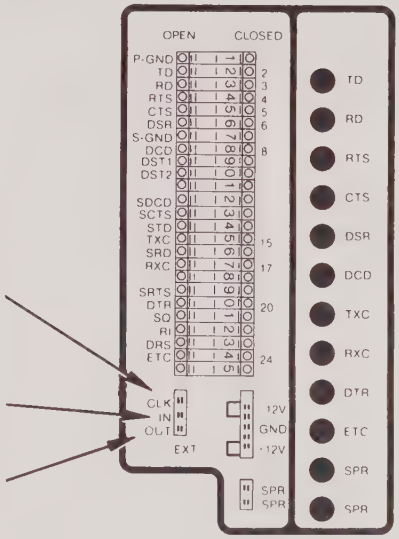



Figure 2-1. Front Panel "Breakout Box"

Keypad

Pressing [RUN] causes the 801B to begin monitoring the link. Monitoring continues until CAPTURE is pressed.

Allows you to examine the current data by momentarily "freezing" the display; data continues to accumulate in the capture buffer. Pressing [FREEZE] again returns the normal RUN mode display.

Alternately displays data as characters or as hexadecimal equivalents in RUN and capture modes.

Used in conjunction with the number keys 0 through 5, this key selects the menu of interest:

PAGE 0: DATA/STATUS (data off the link)
PAGE 1: LINE/DISPLAY (sets up parameters)
PAGE 2: START/STOP (triggers)
PAGE 3: COUNTER
PAGE 4: PRINTER/POLL/BERT
PAGE 5: AUTOMONITOR
PAGE 6: SOFTWARE RESET (clears system variables)

Hardware reset. (Volatile data such as configurations and the data in the capture buffer are unchanged.)

Used in PPB-II operations to enlarge the function of the keypad:

FUNCTN B = <bad BCC>
FUNCTN C = Character set (ASCII only)
FUNCTN F = "Fox message"

Stops the RUN mode and calls up the "capture page" (PAGE 0). The data contained in the buffer may then be analyzed, output to a printer, etc.

Initiates polling and BERT programs.

In the capture mode, prints X.25, SNA, or DDCMP link transactions in easy-to-understand mnemonics.

Operable on the setup pages (PAGE 1, 2, 3, or 4) to return the configuration to the default settings for that particular protocol or code.

Operable in the capture mode. Pressing [SHIFT] followed by [SCROLL (up or down)] initiates automatic scrolling; the data then stream up or down the CRT. Press [HOME] (or any other SHIFT function) to stop the automatic scroll.

On the configuration pages, provides a nondefinitive entry for character or bit entries. On the CRT, it appears as a dim "X" in reverse video. Also operable in the run mode to alternately disable and enable the start/stop function.

Used when monitoring SYNC protocol; forces logging and display of data without detection of sync characters. Pressing the key again returns the system to synchronous operation.

This toggle alternately initiates and disables display of turnaround time. Turnaround time is measured from the trailing pad character on one side of the line to the first sync character in the response. Also, places the display into the time-multiplex mode.

Pressing [MARK] enables you to mark data of interest. The marked characters are logged and displayed with a blinking underline; later, when scrolling through the capture buffer, the marked characters are easy to find.

On any of the setup pages, place the cursor in the reverse video field, and repeatedly press [ENTER] to step through the choices. Also, pressing [ENTER] terminates character, number, or bit string entries.

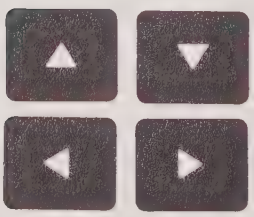
Pressing [CLEAR] clears character string fields (start/stop strings, for example), thus opening that field for your entry. Also operable after RESET or after power up to enter the self-test mode.

Pressing these keys causes captured data to scroll upward or downward on the screen. Movement continues as long as the key is pressed. See also "Step Scroll" and "Automatic Scroll," page 3-10.

In the RUN mode, repeatedly pressing [SCROLL-up] causes the CODE to change for both the DTE and DCE sides of the line; [SCROLL-down] changes the code for the DCE side only. Finally, pressing [SCROLL-up or -down] causes setup page selections to be stepped in reverse order.

On PAGE 0 (in the capture mode), pressing [HOME] brings the capture buffer display to the top of the buffer (the display is labeled "LINE 0001"). Also, on the setup pages, returns the cursor to the top leftmost field on the page.

Operable in the capture mode to shift the data in the video buffer one bit to the left. Often used in conjunction with the [TRANSP SYNC] key.



Consider these to be two pairs of keys, up/down and left/right. On the capture page, (up) moves the cursor upward on the display, one line at a time. The cursor-down key has the opposite effect. Cursor-left moves the cursor one column to the left; cursor-right the opposite. On thesetup pages, the cursor moves from field to field more or less in the direction of the arrow.

## 2.5 REAR PANEL -- CONNECTING THE 801B

### Power

The power switch is labeled OFF and ON. The instrument can operate from a line voltage of either 115 or 230 Vac (+/- 10%). Ensure that the proper voltage source is available before applying power. The 2A FB fuse is located in the power receptacle, just above the plug. Use a small flat screwdriver to open the fuse compartment.

### EIA Line Interface (RS-232-C Connector)

The 801B contains a built-in RS-232-C serial port to interface with either terminal (DTE) or modem (DCE) equipment via its rear-panel female 25-pin D-type connector. No special cabling is required.

### Application 2-1. Connecting the 801B

Monitoring a link:
Set the front-panel rotary switch to MON

801B simulating a
DCE device. Set the front panel rotary switch to SIM DCE.

801B simulating a
DTE device. Set the front panel rotary switch to SIM DTE.

Review the front panel LEDs to verify the proper connection.

Complete instructions on monitoring a link may be found in Section 3, below; polling and responding to poll (which uses the SIM DCE and SIM DTE switch settings) are covered in Section 4.

Current Loop Interface

The 801B contains a built-in current loop interface. Note: the 801B can receive data (monitor) through this interface; transmitting (polling) is not implemented.

## Application 2-2. Connecting the 801B to a Current Loop

1. Set the three-position toggle switch to 20, 40, or 60 mA to match the loop under test.

2. The TRANSMIT and RECEIVE slide switches should be set to ACTIVE or PASSIVE, depending on the particular loop. (See figure 2-2.)

3. Connect the loop to the 801B via the terminal posts, labeled TX+, TX-, Rx+, and Rx- (for transmit and receive, positive and negative). Again, refer to figure 2-2.

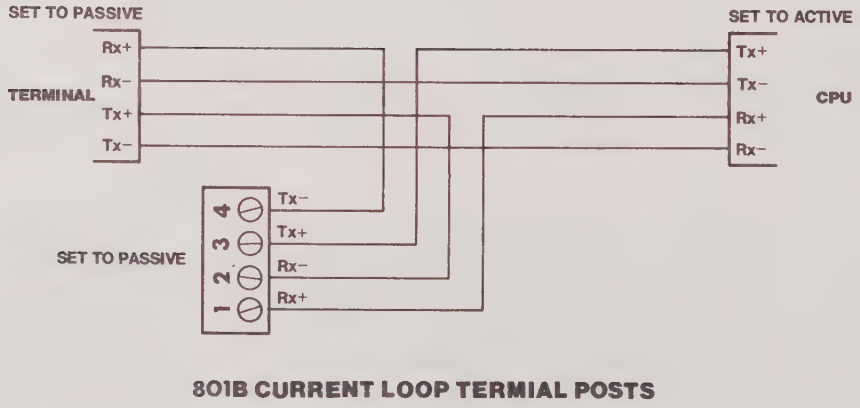


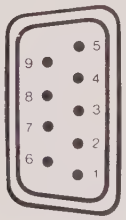

Figure 2-2. Interfacing the 801B to Current Loop Circuits

## Video Outputs

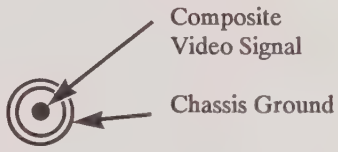
The 801B features B&W and digital RGB outputs for an external monitor. The composite video interface consists of a female RCA-type (phono) jack labeled "COMP" (composite video). Its output power is at 75 ohms impedance. Its output drive is approximately 1.5V.

The RGB output, a 9-pin D-type connector, is at TTL levels, and is compatible with the IBM-PC*. It is configured as follows:

| | | | | | |
|---|---|---|---|---|---|
| 1 | Ground | 4 | Green | 7 | Reserved |
| 2 | Ground | 5 | Blue | 8 | Horizontal Drive |
| 3 | Red | 6 | Reserved | 9 | Vertical Drive |




RGB Connector




Composite Video Jack

Figure 2-3. 801B Video Connectors

## Adjusting the CRT for 50Hz or 60Hz Operation

A value of :50 at the 801B's memory address :E800 sets the 801B to operate at 50Hz. Any other value sets the system for 60Hz. To set the system for 50 or 60 Hz, press:

RESET, PAGE, CLEAR, 6, E, 8, 0, 0, <50 or 60>, CLEAR, RESET.

See Sec. 3.9, Test #2, for more details.

## Rack Mounting

The analyzer can be mounted in a 19-inch or 23-inch rack using the optional rack adapters. Follow the instructions in the rack booklet.

---

* IBM-PC is a registered trademark of International Business Machines Corporation.

## 2.6 BATTERY PACK - DATA SAVER

The 801B contains a built-in 3V lithium battery which supplies sustaining power to the RAM whenever the unit is turned off or disconnected from AC power. Since the battery serves only low-power CMOS RAM, the battery life is three to five years. The battery is not rechargeable.

Continually supplying power to the RAM means that as long as the battery retains some charge, data is never lost. Monitored data, which reside in capture buffer RAM, and your specific monitoring and configuration parameters (in system RAM) survive interruptions in external power.

### Hardware Reset vs. Software Reset

Pressing the [RESET] key invokes the hardware reset, which rudely terminates all ongoing activities and brings up the PAGE menu. The 801B stops, but it retains the existing data and configuration choices. On the other hand, the software reset (selection 6 on the PAGE menu) clears the capture buffer and returns all selectable parameters to their default values. Selection 6 on the PAGE menu invokes the software reset. Note that pressing the [CONFIG] key performs a limited software reset: it resets the configuration and counters for a particular protocol to the default values.

### Changing the Battery

The "coin-type" battery (type CR2032 or BR2325) is available from CXR Telcom, part number 4000-0100-03. The battery is approximately the size of a U.S. Quarter, though slightly thicker. The battery is mounted on a special retainer on the main circuit board near the rear panel. To change the battery:

1. Unplug the 801B from AC power.

2. Using a flat screwdriver, loosen or remove the four screws on the unit's top cover, then remove the cover.

3. With the CRT facing you, find the battery. It is clearly visible clipped to its round receptacle, which is located on the main circuit board, slightly left of center and adjacent to the rear panel.

4. Using a small screwdriver or your thumbnail, gently pry up the front edge of the battery, then slide the battery toward you out from under the clip.

   Note that the positive [+] side is up.

5. Slide a new battery in place under the clip. (Remember, positive [+] side up.) Replace the top cover.

# SECTION 3 -- BASIC OPERATING INSTRUCTIONS

## 3.1 GENERAL

Essentially, "operating" means monitoring a link, setting start/stop triggers, and obtaining counts of various events (such as errors, elapsed time, start/stop triggers, etc.). The 801B is controlled by settings made to various menus (called "pages"). This section begins with an overview of the setup and display pages (menus), then describes its operating modes and functions, and includes detailed operating instructions.

## 3.2 OVERVIEW OF OPERATION

Operating the 801B consists of three basic steps:

| | | |
|---|---|---|
| 1) | Connect: | For most monitoring applications, special connectors or adapters are not required. The 801B contains a built-in breakout box, conveniently located on its front panel. |
| 2) | Setup: | In many applications you can let the 801B's Automonitor perform the line setup. If you need to make any changes, simply bring the LINE/DISPLAY page to the screen, place the cursor in the field to be changed, and repeatedly press [ENTER] until the desired configuration appears. |
| 3) | Gather Data: | After 801B has been configured for the test, just press [RUN]. Data off the link accumulate in the capture buffer. This action continues until you press [CAPTURE], or until the instrument encounters a "stop string" or some other triggering event. |

### Initializing

When the 801B is first powered up, the word "INITIALIZING" flashes on the screen. (This may not be visible from a cold start, because it takes about 20 seconds for the CRT to warm up.) This indicates that the 801B is performing its self-test.

## Overview of the Pages

When the self-test passes, the following message appears.

```
 SELECT DESIRED PAGE
0 : DATA/STATUS PAGE                (Run mode / Capture Mode)
1 : LINE/DISPLAY PAGE               (Line, Display, & Monitor)
2 : START/STOP PAGE                 (Triggers)
3 : COUNTER PAGE                    (Event Counters)
4 : PRINTER/POLL/BERT PAGE          (See section 4 of this Manual)
5 : AUTOMONITOR
6 : SOFTWARE RESET                  (Clears RAM, see Sec. 3.6)
 CLEAR TO ENTER SELF TEST
```

Also, from the capture mode, pressing [PAGE] brings up this menu.

Continue by pressing a number key between 0 and 6. In the following text we refer to these pages as "PAGE 0", "PAGE 1", etc. This means press the [PAGE] key, then press the number key.

NOTE: The following subsections are written in the sequence that a technician would most likely follow when monitoring a link. You are encouraged to read this text with a 801B nearby; experiment by making the keystrokes as you read the text.

Each subsection contains "Applications" to show you how to use the features described in the preceding pages.

If you're feeling adventurous, you can learn to operate the 801B by performing the applications in order. Read the paragraphs immediately above the application if you run into trouble or need clarification.

## 3.3 AUTOMONITOR MODE

The Automonitor mode makes it simple to set up the 801B for monitoring. You need only connect the 801B to a data link, plug it in, and turn it on. When you press [PAGE 5], the AUTOMONITOR display appears:

Figure 3-1. The AUTOMONITOR Display

If the link is inactive (or if the 801B is disconnected from the link), the words

>>>----> NO DATA <----<<<

appear. If the link is active,

>>>----> IN PROGRESS <----<<<

replaces the line. "IN PROGRESS" tells you that the 801B is examining both the DTE and DCE sides of the link to determine the protocol, bit rate, transmission code, and other parameters. When the parameters are detected for one side of the line, the 801B then enters the run mode, storing the data and displaying them at the same time. (The run mode is given detailed coverage under Sec. 3.4, below.)

You may then exit the run mode (by pressing [CAPTURE]) and enter the setup mode (by pressing [PAGE 1]), on which you can set up the line configuration and other parameters manually.

Determining Transmission Codes on Asynchronous Lines

Due to the nature of the asynchronous or BCP data, the Automonitor mode is unable to determine the transmission code. For this reason the transmission code is "UNDEFINED," although the number of bits per character is displayed. Therefore, the data is displayed in hexadecimal at first.

To determine the transmission code, repeatedly press [SCROLL-up], which causes the 801B to step through the transmission codes. When the data becomes intelligible, you've found the proper code. In case the codes for the two sides of the line are different, select the correct code for the DTE side using the [SCROLL-up] key, then select the correct code for the DCE side by pressing the [SCROLL-down] key.

You can select other functions during the run mode; see Sec. 3.4, following.

## Application 3-1. Introduction to Monitoring, Part 1: The Automonitor

This application serves both to demonstrate the Automonitor and to introduce you to operating the 801B. To perform this exercise, you need an active asynchronous link (e.g., between a modem and an async terminal).

> (Incidentally, this manual was written on a 40-user minicomputer. Where applicable, the Applications--especially those that describe an "active asynchronous link"--were tested while the writer was composing the text. This particular link was asynchronous, 4800 b/s, 8 bits/character, 1 stop bit, and no parity.)

1. Using the technique given in Application 2-1, "Monitoring," connect the 801B to the active asynchronous (RS-232-C) line.

2. Power up the 801B. Verify that the communications line is active: various LEDs should light up. TxD and RxD (pins 2 and 3) should turn amber as transmissions occur. Other LEDs such as DTR, RTS, CD, and CTS may or may not light up, depending on your particular interface.

3. After initializing, the CRT displays the PAGE menu, described on page 3-2 above. Press the [5] key, calling up the Automonitor.

4. If the link is active, data soon begins to stream down the CRT. The 801B has now entered the "run mode".

The top lines on the CRT show the line configuration for both sides of the line. The lines may read "ASYNC UNDEF" (async protocol, undefined code).

5. Repeatedly press [SCROLL-up]. When the first lines of the screen change to read ...ASCII..., the data should become intelligible.

## Application 3-1. (Cont.)

6. Get used to operating the 801B by performing the following keystrokes. Study the results of each keystroke.

Also, it may be helpful to perform Application 3-2 in conjunction with this procedure, as minor changes to the setup are often required.

- Press [FREEZE/RESUME]. The display "freezes;" 801B continues monitoring. Press [FREEZE/RESUME] again; the display is again active.
- Press [CODE/HEX]. The data is displayed in hexadecimal. Press it again; the data is displayed as characters.
- Press [MARK], wait a few moments, then press [MARK] again. Observe the result. During the capture mode, the "marked" data will be easy to find.
- Press [CAPTURE]. The 801B stops monitoring--it enters the "capture mode". Notice how the top of the screen changes.
- While the unit is in the "capture mode", observe the operation of the [SCROLL-up], [SCROLL-down], and [HOME] keys. Move the cursor around the screen by pressing the cursor control keys.
- In order, press: [PAGE], [1], [PAGE], [2], [PAGE], [3], [PAGE], [4], [PAGE], [0], [RUN], and observe the result of each keystroke.

## 3.4 RUN MODE

As mentioned above, the 801B enters the run mode as part of the Automonitor. You can, however, place the 801B in the run mode at any time by simply pressing [RUN]. In the run mode, the 801B displays PAGE 0, the DATA/STATUS page.

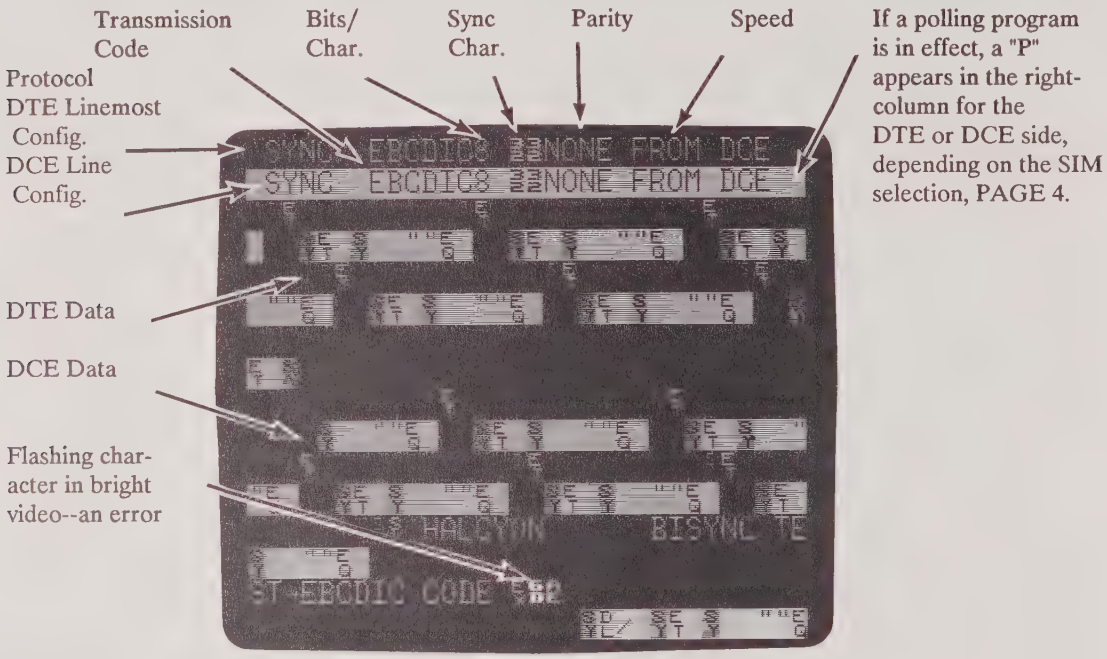

Transmission Code
Bits/ Char.
Sync Char.
Parity
Speed
If a polling program is in effect, a "P" appears in the right-column for the DTE or DCE side, depending on the SIM selection, PAGE 4.
Protocol
DTE Linemost Config.
DCE Line Config.
DTE Data
DCE Data
Flashing character in bright video--an error

Figure 3-2. The DATA/STATUS Page

(RUN Mode: Monitor Function / LINE MUX-PAD Display*)

* In the RUN mode the 801B is activily monitoring the link. "Monitor Function" refers to the selection on PAGE 2, FUNCTION: MONITOR (the default condition); and "LINE MUX-PAD Display" refers to the DISPLAY MODE selection, PAGE 1.

### Monitor Function

In the monitor function, the 801B stores and displays link transactions. (Other functions are described in Sec. 3.8 below.) The first two lines on the screen provide an abbreviated display of the line configuration parameters (PAGE 1 selections). DTE data is displayed in normal video (white on black); DCE in reverse video (black on white). The DTE and DCE data is then displayed on every other line to the bottom of the display. Pad characters are displayed as blanks (spaces) between turnarounds.

You can perform the following operations while the 801B is monitoring:

- o freeze
- o transparent sync / resync
- o code/hex display
- o turnaround time
- o mark
- o capture
- o transmission code selection.

Freeze

To stop the display, press [FREEZE]. Data continues to accumulate in the capture buffer. Press [FREEZE] again to resume the real-time data display.

Code/Hex

The received data is normally displayed as characters. Repeatedly pressing [CODE/HEX] toggles the display between characters and hexadecimal.

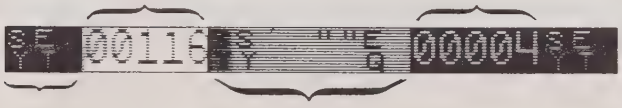
Transparent Sync / Resync

This feature is used for monitoring synchronous protocols only. For sync protocols, monitor searches for sync characters ("opening flags") before logging data. Pressing [TRANSP SYNC] allows logging and display of the data without detection of the sync characters. (The displayed data may not be synchronized. Use the bit-shift operation, as described at the end of Sec. 3.5, below, to decipher the message.) Pressing [TRANSP SYNC] again causes the 801B to restore synchronization.

Turnaround Time

Turnaround time (measured in sync protocol) is the time between the last character received from one side of the line, and the first sync character received from the other. Press [TURN AROUND] to enter the "time multiplex" display mode, and then press [TURN AROUND] again to calculate the turnaround times. The calculated times (in milliseconds) are displayed, in bright intensity, in the space between the DCE and DTE data blocks on the screen. The DCE-to-DTE turnaround time is displayed in normal video; DTE-to-DCE in reverse video, bright intensity.

DTE/DCE Turnaround Time DCE/DTE Turnaround Time




DTE Data DCE Data

Figure. 3-3. Time-multiplex Display Mode / Turnaround Time

To cancel the turnaround time function, press [TURN AROUND] again. To return to the "line multiplex" display mode, press [CAPTURE] and then press [PAGE 1] to enter the line configuration page, and change the display mode to LINE MUX with PAD.

### Mark

Press [MARK] to highlight ("mark") a portion of the data stream. The data is marked by a blinking line under each character as it is displayed on the screen. Press [MARK] again to stop the mark feature. The blinking underline attribute is recorded in the capture buffer along with the data.

Note: You can set up the the 801B to mark data on events occurring on a selected EIA lead; see the "MARK EXT IN" paragraphs under Sec. 3.5, below.

### Transmission Code Selection

This operation enables you to change the transmission code (ASCII, EBCDIC, etc.) while the 801B is actively monitoring the link. Separate selections can be made for both sides by pressing the appropriate [SCROLL] keys, as follows:

Pressing [SCROLL-up] changes the codes for both sides; [SCROLL-down] changes the DCE side only. The capture buffer and the display are cleared and the new code is identified on the top lines of the display. Subsequent data for both DTE and DCE sides of the line are logged and displayed using this code. Continuing to press [SCROLL-up] repeats this action for each available code. None of the other parameters, including bits per character, are affected by this action.

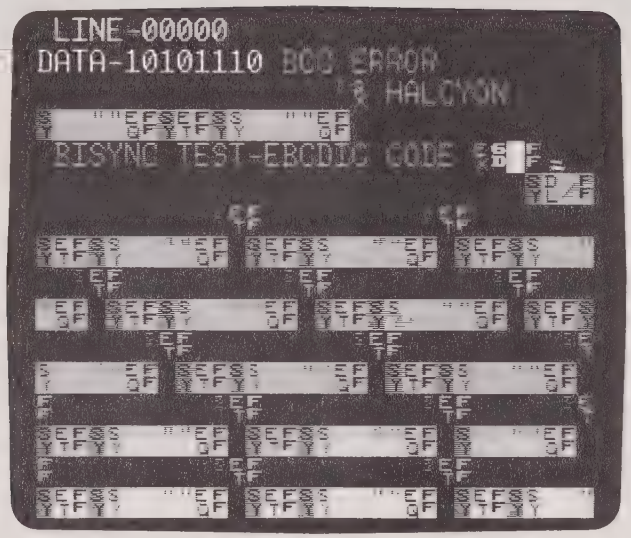
### Capture

In the capture mode the stored data may be analyzed. The 801B enters the capture mode when you press [CAPTURE], or when it encounters a stop trigger. The operations that can be performed in the capture mode are described below. To return to the run mode, press [RUN].

## 3.5 CAPTURE MODE

Line Number

Data Bits




Error Type

Cursor placed over flashing character

Figure 3-4. PAGE 0, The DATA/STATUS Page (Capture Mode)

Although the capture buffer can hold about 8000 characters, the CRT can display only 512 or 1024. The CRT displays fourteen lines of data; the LINE field shows you where, in the capture buffer, the data resides. The DATA field indicates the data bits of the character under the cursor. A flashing character indicates an error; placing the cursor over the flashing character causes the error type to be displayed.

As in the run mode, the type of data displayed depends on the FUNCTION selection, PAGE 2. See Sec. 3.8 for details. Several operations are available in the capture mode:

- o code/hex display
- o bit shifting
- o Setup mode
- o event counting
- o cursor positioning
- o scrolling

### Code/Hex

The [CODE/HEX] key operates in the capture mode in the same manner as described under RUN MODE, above: pressing [CODE/HEX] toggles the data display between characters and hexadecimal.

## Scroll

The display presents only a portion of the data stored in the capture buffer. Pressing [SCROLL-up] or [SCROLL-down] or [HOME] shifts the display through the buffer. As the data scrolls, the line number (on the first line of the screen) changes, indicating the location of the cursor in the data buffer.

The 801B incorporates two scrolling functions: step scroll, and automatic scroll.

### Step Scroll

Normally (in the LINE MULTIPLEX-PAD mode), pressing the [SCROLL] keys causes the display to shift upward or downward two lines at a time. In this way, DTE data always appear on the third line of the display. We may say, then, that the step scroll value is 2.

On the other hand, in the TIME MUX, DISPLAY DTE, and DISPLAY DCE display modes the display shifts one line at a time whenever you press a [SCROLL] key: the step scroll value is 1.

It is often convenient to set the step scroll value to 14, thus enabling you to scroll page by page through the data. To change the step scroll value:

1. Press [CLEAR].

2. Using the number keys, enter a new step value.

3. Press [ENTER] to terminate the entry.

To move rapidly to the bottom of the capture buffer, set the step scroll value to an impossibly large number, for example, 999. Then press [SCROLL-up]. Since the 801B cannot scroll past the end of the buffer, one or two presses brings you to the end. (Once there, enter a new value.) Pressing [HOME], of course, brings you back to the top.

### Automatic Scroll

Press [SHIFT] followed by either of the [SCROLL] keys. The data then streams upward or downward on the display until:

1. You come to the end of the capture buffer, or

2. You press either of the [SCROLL] keys, or [HOME].

The automatic scroll function comes in handy when you want to search through the capture buffer to find some data of interest, such as data "marked" with the blinking underline.

### Cursor

The "home position" of the cursor is on the first character in the buffer--the left-most character on the third line on the screen. Using the CURSOR keys, the cursor can be moved to any data position on the screen. The CURSOR keys move the cursor in the direction of the arrows throughout the display. As the cursor moves, the bit pattern and error indication (given on the top of the display) change, indicating the status of the character under the cursor.

### Bit Shift

The bit shift operation is often used in conjunction with the TRANSP SYNC function (described in Sec. 3.4, above).

The display may sometimes show legible data that suddenly become garbled. This usually happens when transient hits on the data line add or take away bits from the data stream. The bit-shifting function can decipher the message or locate the shifted or extra bit.

To perform this operation just press [BIT SHIFT]. The data in the video buffer (not the capture buffer) shifts one bit to the left. (The data bits within each character are shifted to the right.) Repeated pressing shifts the display through the character length, and the original characters are displayed, shifted left one position.

### Reset

The [RESET] key is always active; pressing it returns the 801B to the PAGE menu. All parameters and capture buffer data are saved. Note the difference between this and the software reset (the PAGE 6 selection) which clears existing configurations and the capture buffer. See also Sec. 2.6.

## 3.6 PAGE 1 - LINE/DISPLAY PAGE

During the capture mode (when the 801B is not RUNning), pressing [PAGE 1] brings up the LINE/DISPLAY CONFIGURATION PAGE, referred to as PAGE 1.

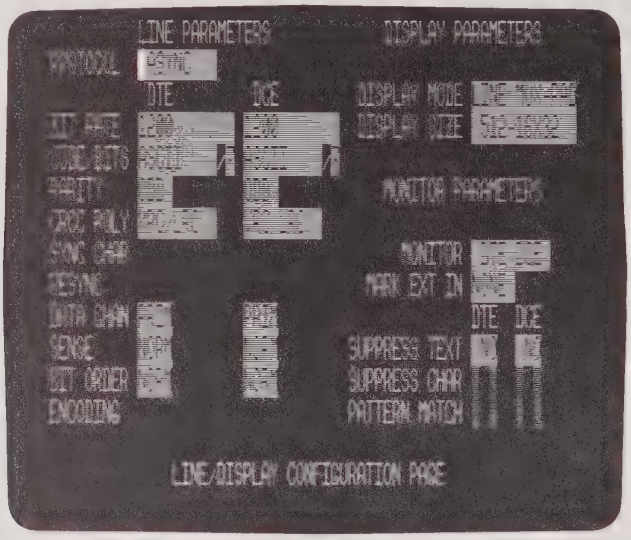



Figure 3-5. The LINE/DISPLAY Page

Study figure 3-5 (or observe PAGE 1 on your 801B). Each parameter is followed by one or more reverse video fields. Most of the fields have a bright background. These are the "selectable fields". To make a selection, use the cursor keys (across the bottom of the keypad) to place the cursor in the field you wish to change, then repeatedly press [ENTER] until your choice appears. (If you pass your selection, press [SCROLL-up] or [SCROLL-down] to reverse the order in which the selections appear.)

The dim reverse video fields after "SUPPRESS CHAR" and "PATTERN MATCH" (located on the lower right corner of the display) are the "data entry fields." In these, you enter characters (usually in hexadecimal). This procedure is described in detail under "Data Entry Fields," below.

PAGE 1 is divided into three sections: "LINE PARAMETERS," occupying the left-hand column, "DISPLAY PARAMETERS," the first two entries in the right-hand column, and "MONITOR PARAMETERS," which make up the rest of the page.

Making changes to the LINE PARAMETERS sets up the 801B to match the link. The line parameters include:

- o protocol
- o number of bits
- o sync characters
- o data bit order
- o bit rate
- o parity
- o resync characters
- o data encoding
- o transmission code
- o CRCC polynomial
- o data sense
- o data channel assignment

The DISPLAY PARAMETERS selections govern only how the data is displayed--not how it is logged into the capture buffer. The data from both sides of the line is still stored and can be selected for display once the 801B enters the capture mode. The selections include:

- o display mode
- o display size

The MONITOR PARAMETERS control how the data is logged into the capture buffer. The selections include:

- o Monitor
- o Suppress Text
- o Pattern Match
- o Capture (RAM pak only)
- o Mark External EIA Input
- o Suppress Characters

PROTOCOL Field

Six protocols are provided with the monitor:

- o ASYNChronous
- o SYNChronous (which includes Bisync, Burroughs, Honeywell, and other synchronous byte controlled protocols)
- o IPARS
- o DDCMP (synchronous)
- o SDLC
- o HDLC

PROTOCOL is "selectable": place the cursor in the PROTOCOL field and repeatedly press [ENTER] until your choice appears.

The remainder of the LINE/DISPLAY page changes slightly as different protocols are selected. HDLC and SDLC, both bit-oriented protocols, do not check for parity errors; therefore, the PARITY selection is blank.

BIT RATE Field

The 801B contains 15 internal bit rates: 50, 75, 100, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, and 19,200 bits per second (b/s).

Four external rates are provided: FROM DCE, FROM DTE, external times 1 (EXT X1), and external times 16 (EXT X16).

The default BIT RATE setting varies among the protocols: 1200 b/s for ASYNC, and FROM DCE for all others.

The field is "selectable." Note also that the selections for the DTE and DCE sides of the line are independently selectable. Changing the left-hand DTE field affects both sides; but changes can be made to the DCE column independently.

### CODE/BITS Field

This is a dual field: "Transmission Code" / "Bits per character." The "/BITS" selection defaults to the standard for the code, but the value can be changed. The DTE and DCE sides can be selected independently as described in "Bit Rate," above. The following list gives the transmission codes and the default values for bits/character:

- o ASCII/7
- o EBCD-2740/7
- o EBCDIC/8
- o SELECTRIC/6
- o SBT/6
- o UNDEFINED/8
- o IPARS/6
- o BAUDOT/5

(UNDEFINED is displayed in hexadecimal.)

### PARITY Field

Choose ODD, EVEN, or NONE (no parity) for ASYNC and SYNC protocols. Different selections can be made for each side of the line.

### CRCC POLYnomial Field

Four different cyclic redundancy check character (CRCC) polynomial selections are provided: VRC/LRC, CRC-16, CRC-6, and CCITT-16. The default conditions vary with the protocol, viz:

| Protocol | CRCC | Protocol | CRCC | Protocol | CRCC |
|---|---|---|---|---|---|
| ASYNC | VRC/LRC | SYNC | CRC-16 | IPARS | CRC-6 |
| SLDC | CCITT-16 | HDLC | CCITT-16 | | |

Separate selections can be made for each side of the line.

### The "Data Entry" Fields

The SYNC CHAR field brings us to the first of the "data entry" fields. The data entry fields appear as reverse dim video columns, each column receiving one character (i.e., two hex digits). For the SYNC CHAR, RESYNC, SUPPRESS CHAR, and PATTERN MATCH fields, up to two hex characters can be entered. (On PAGE 2 you can enter up to 8 characters in a particular hex entry field; on PAGE 4, up to 16 characters.) In all cases, however, the procedure for inputting a data entry field is identical:

1. Press [CLEAR]. This deletes the existing characters (if any), and opens the field for data entry. You must always perform this step, even if the field is initially blank.

2. To enter hexadecimal characters:

   a. Press the keys for the hex code of the character to be entered. To enter the ASCII character <STX>, for example, first press the "0" key, then the "2" key.

   b. The cursor automatically advances to the next reverse dim video character position in the field. To terminate the field with only one entry, press [ENTER]. The cursor advances to the next field.

c. To enter a second character, follow the instructions in step 2.a. When the last character for a particular data entry field is entered, the cursor jumps to the next field. In this case, it is not necessary to press [ENTER].

d. If you make a mistake in keying:

- o Complete the character by entering a second hex digit (if necessary).
- o Press [ENTER].
- o Using the cursor control keys, place the cursor on the character in error.
- o Press [CLEAR] to delete it and all characters to the right.
- o Continue with step 2.a.

e. The "DON'T CARE" character (displayed as a dim "X" in reverse video) is usually a legal entry. (See Application 3-6 and following for examples of the "DON'T CARE" character.)

3. To enter binary numbers (where required), press the "0" key, or the "1" key, or [DON'T CARE].

4. To enter data entry fields in decimal, only the digits "0" through "9" are legal.

To recap the "data entry" procedure:

1. [CLEAR] the field.
2. Enter the character(s) in hex, decimal, or binary, as needed.
3. Press [ENTER] to "lock in" the selection.

SYNC CHARacters Field

You may enter one or two sync characters for use in synchronous protocols. Note: "sync characters" = "flags" in bit-orented protocols. The default sync characters (in hexadecimal) vary with the transmission code:

| Code | Sync Chars | Code | Sync Chars |
|---|---|---|---|
| Bisync | | Bisync | |
| ASCII | :16 and :16 | EBCDIC | :32 and :32 |
| IPARS | :3F and :3E | SBT | :3A and :3A |
| | DDCMP Protocol: | :96 and :96 | |

Any characters can be manually selected. Different characters can be entered for each side of the line. For Baudot, Selectric, EBCD-2740 and undefined codes, the default SYNC CHAR is "X", the "don't care" character. (These codes are normally used in ASYNC applications.)

### RESYNC Field

In BOP the default RESYNC character is :7E. In all other protocols the 801B resyncs on the idle line condition, which appears as a :1F character for 5-bit codes, :3F for 6-bit, :7F for 7-bit, and :FF for 8-bit codes, except :00 for IPARS, which operates under inverted data sense. Any characters can be manually selected for each side of the line.

### DATA CHANnel Field

In this "selectable" field, press [ENTER] to select the PRIMary channel (pins 2, 3, 4, etc.) or SECondary channel (pins 14, 16, 19, etc.) for either or both sides of the interface. The third selection, CRLP, enables the 801B's current loop interface.

RS-232-C Lines:

| PRIM | SEC | Signal Name |
|---|---|---|
| 2 | 14 | TxD |
| 3 | 16 | RxD |
| 4 | 19 | RTS |

RS-232-C Lines:

| PRIM | SEC | Signal Name |
|---|---|---|
| 5 | 13 | CTS |
| 8 | 12 | CD |

### Data SENSE Field

The selections are NORMal and INVT (inverted) for either or both sides. Inverted data sense is used in IPARS protocol and in transmissions conforming to MIL-188 standard.

| Selection | Function |
|---|---|
| NORM | 0 = +12V, 1 = -12V |
| INVT | 0 = -12V, 1 = +12V |

### Data BIT ORDER Field

Selections of NORMal and REVerse data bit order are provided for each side of the line. The default condition is normal.

| Selection | Function |
|---|---|
| NORM | LSB (least significant bit) received first. |
| REV | MSB (most significant bit) received first. |

Data ENCODING Field

Press [ENTER] to select DIRect or non-return-to-zero-inverting (NRZI) data encoding for use with SDLC and HDLC. Default: DIRECT.

## Application 3-2. Introduction to Monitoring, Part 2: The LINE CONFIGURATION Parameters

This example expands upon the material presented in Application 3-1. The example is written under the assumption that you are monitoring an active asynchronous link that is transmitting ASCII code.

1. Press [RESET] to place the 801B in its default state. The page menu appears. Press [5] to invoke the Automonitor.

2. When the 801B enters the run mode, press [CAPTURE].

3. Press [PAGE], [1].

4. Using the cursor control and the [HOME] keys, practice moving the cursor around the screen. After you become familiar with moving the cursor, press [HOME] to return the cursor to the home position, which, on PAGE 1, is the PROTOCOL field.

5. Repeatedly press [ENTER] and observe the selections. Notice that the rest of the screen changes slightly when the different protocols are selected.

6. Press [SCROLL-up] to reverse the order in which the selections appear. Press [SCROLL-down] to reverse the order again.

In the PROTOCOL field, select ASYNC.

7. Move the cursor to the following fields, and repeat steps 5 and 6. BIT RATE, CODE/BITS, (should start out as ASCII/7), and PARITY (as required).

Make the proper selections to these fields as required to match the link.

8. To restart monitoring, press [RUN].

## Application 3-3. How to Select the Bit Rate

| | |
|---|---|
| ASYNC Protocol: | Select a bit rate to match that of the line under test. |
| SYNC BCP | If the TxC and RxC signals (Transmitter and Receiver and BOP: Clock, RS-232-C pins 15 and 17 respectively) are produced by the modem, select FROM DCE. If the DTE device produces the timing (pin 24), select FROM DTE. |

The discussion now continues with PAGE 1's DISPLAY PARAMETERS fields.

DISPLAY MODE Field

This parameter determines the way the received (or captured) data is displayed on the CRT. Four selections are available:

- Line Multiplex (LINE MUX)
- Line Multiplex with Pad (LINE MUX-PAD)
- Time Multiplex (TIME MUX)
- DISPLAY DTE (or DISPLAY DCE)

LINE MUX

In the line multiplex mode the received data from the DTE and DCE side of the line is displayed on alternate lines on the screen; the DTE data begins on the third line and the DCE data on the fourth.

LINE MUX-PAD

Same as LINE MUX except that (in half-duplex applications) each line of data is "padded" with blanks while the other line is transmitting. This helps show the time-correlation between DTE and DCE transmissions. LINE MUX-PAD is the default display mode.

TIME MUX

In the time multiple mode the DTE and DCE data is displayed on the screen on the same line in the same order that it was received. If you press [TURN AROUND] while actively monitoring a link, the 801B automatically switches to the TIME MUX display mode. To return to the default LINE MUX-PAD display, you must press [CAPTURE], placing the 801B in the capture mode, then press [PAGE 1], and manually change the DISPLAY MODE field back to LINE MUX-PAD.

DISPLAY DTE / DISPLAY DCE

Selecting DISPLAY DTE or DISPLAY DCE causes the CRT to display the data from one side of the line only. Note that data from both sides is still logged into the capture buffer.

Figures 3-2 and 3-3 give examples of the line mux-pad and time-mux displays.

DISPLAY SIZE Field

Press [ENTER] to select the size of the data display, either 512 characters (16 lines of 32 characters each) or 1024 characters (16 lines of 64 characters each).

We now arrive at the MONITOR PARAMETERS section.

MONITOR Field

This "selectable" field controls what data is actually logged into the capture buffer. Four selections are available:

o DTE o DCE o BOTH o FAST

If you choose DTE or DCE, the capture buffer will contain the data from the selected side only. The default setting is, of course, BOTH.

The "FAST" selection permits the link to be monitored at rates up to 64 kb/s. In this case, data is logged into the capture buffer but is not displayed in real time. Start/stop, suppress text and character, and counter operations are inoperable during the FAST MONITOR function.

MARK EXTernal INput Field

This selection causes the 801B to monitor a selected EIA lead and mark the data with the blinking underline when an event occurs on that lead; i.e., a positive or negative transition, or when the lead is in marking or spacing condition. Repeatedly press [ENTER] to select DOWN (negative transition), UP (positive transition), MARK, SPACE, or NONE. The default condition is none.

## Application 3-4. Marking Data When SQD Drops

1. On the front panel, connect a jumper from pin 21 (SQD) to the EXT IN socket (on the lower left of the breakout box).

2. On PAGE 1, make the normal selections to match the 801B to the link. In the MARK EXT IN field, select SPACE.

3. Press [RUN]; monitor the link.

4. Data received while SQD is "low" are marked with the blinking underline.

SUPPRESS TEXT Field

Suppresses storage and display of text (i.e., all data between <STX> and <ETX> characters); in HDLC and SDLC protocols, suppresses the I field. Separate selections can be made for each side of the line. The default condition is "NO".

Note: SUPPRESS TEXT must be set to "NO" during PPB operations.

CAPTURE Field (RAM Pak only)

This "selectable" field controls where the "captured data will be stored (retained). The default setting is "internal". Press [ENTER] to select RAM Pak.

### SUPPRESS CHARacters Field

We come again to a "data entry field"; to enter characters for suppression, press [CLEAR], then enter the characters (in hex), then press [ENTER]. (See page 3-14 for the "data entry" procedure.) Note: the SUPPRESS CHAR fields must be blank during PPB operations.

You can enter up to two characters to be suppressed from the monitored data, for either side of the line. This option is normally used to suppress the storage and display of flag characters during bit-oriented protocols. The default condition is no character suppression (the fields are blank).

When characters other than sync characters are entered, they operate as a logical "OR;" for example, entering :0A and :0D removes all <CR> and <LF> characters from the monitored transmission.

When you specify sync (flag) characters for suppression (i.e., when the entries in this field are identical to the entries in the SYNC CHAR field), the following rules apply:

o If a single flag character is entered, all flag characters are suppressed.

o If two flag characters are entered, all-but-one are suppressed. In this way, the opening and closing flags in BOP are retained.

### PATTERN MATCH Field

When the 801B encounters one- or two-character data that match this entry, the data is marked (with the blinking underline). Only the second character of two-character patterns is underlined. Also, these occurrences are counted. (See Sec.3.7, "Enabling/Disabling the Counters." Note that the PATTERN COUNTER is always enabled.)

Separate selections can be made for each side of the line. The default condition is no pattern match (blank fields).

### CONFIGuration Key

Pressing [CONFIG] returns the menu to its default configuration for the current protocol. Essentially, it wipes out any changes you may have made to the menu.

## 3.7 PAGE 2 -- START/STOP PAGE / PAGE 3 -- COUNTER PAGE

We come now to the START/STOP and the COUNTER pages. The two pages are discussed together, because making a selection on PAGE 2 often means that you have to make a selection on PAGE 3 as well. Note that the allowable entries on PAGE 2 and 3 varies according to the PROTOCOL selection (PAGE 1).

### Overview of the Start/Stop Function

When the start/stop function is in effect, the 801B monitors the link, searching for the start trigger. When the trigger is detected the 801B enters the run mode, storing and displaying data off the link. It continues to store the data until it encounters a stop trigger. At that time the 801B may enter the capture mode, or issue an alarm, or continue monitoring for a preset number of characters, or even resume looking for another start trigger. You have complete flexibility for data monitoring.

You can enter up to three strings to act as start triggers for each side of the line. The data strings for one side of the line can be programmed to operate in either an "AND" or an "OR" configuration, and the two sides of the line can be programmed to operate independently. A signal on a selected external EIA lead can also act as a start trigger.

The stop triggers operate in the same way. Besides manually-entered strings, the 801B can be programmed to stop when it encounters errors (FCS, BCC, parity, etc.), or a transition on an external EIA lead. The EIA trigger, if active, is always in an OR configuration with the start strings.

In bit-oriented protocols the occurrence of a flag can act as the stop trigger.

### FUNCTION Field

This field controls the overall operation of the 801B. Its selections include MONITOR (the default setting), TIMEOUT-STOP, ELAPSED (SEConds or MilliSEConds), or ELAPSED CHARacters.

The MONITOR selection suffices for most applications. When appropriate selections are made to the remainder of the start/stop page, the 801B may be said to be in the START/STOP mode. In that case, the remainder of the selections in the FUNCTION field give further enhancements to the START/STOP mode. These and other start/stop functions are discussed in Sec. 3.8, below.

In the MONITOR mode, the received traffic is displayed, in accordance with the other monitor and display configuration parameters, starting with the start trigger and ending with the stop trigger.

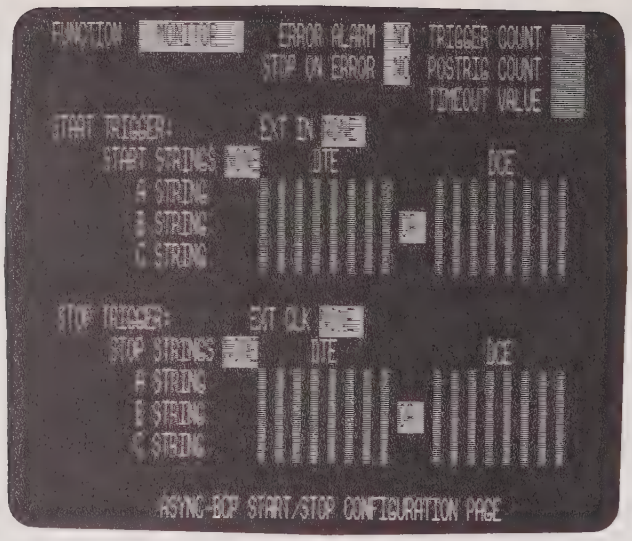



Figure 3-6. The ASYNC/SYNC START/STOP Page

At this time the discussion turns to the lower two-thirds of the display, the start/stop triggers. We will return at the end of this subsection to discuss the ERROR ALARM, TRIGGER COUNT, STOP ON ERROR, POSTRIG COUNT, and TIMEOUT VALUE fields.

Start/Stop Triggers - Overview

Several fields enable triggering: EXTernal INput, EXTernal CLocK, and the string fields. An entry in the START STRINGS or STOP STRINGS fields enables triggering on start/stop strings; the EXT IN and EXT CLK fields enable start/stop triggering on selected EIA leads.

EXTernal INputs Fields
These parameters, labeled EXT IN (start trigger) and EXT CLK (stop trigger) allow a selected EIA lead, patched to the front panel EXT IN or CLK jack, to be used as a start or stop trigger. If selected, these triggers are always active, regardless of the selection in the START STRINGS field.

For the start trigger, place the cursor in the EXT field and press [ENTER] to select MARK, SPACE, UP (positive-going transition), DOWN (negative-going), or NONE (no triggering on external inputs). For stop triggering on an EIA lead, place the cursor in the CLK field and select MARK, SPACE, or NONE.

This function can be used to measure RTS/CTS delay (see application 3-10), or to trigger when SQD drops.

START STRINGS / STOP STRINGS Fields

These selectable fields enable start/stop triggering on characters or strings. Place the cursor in the START (or STOP) STRINGS field and press [ENTER] to select OR, AND, or NONE. A selection other than "NONE" (no trigger) enables start/stop triggering on the strings. The logical OR and AND selections refer to the strings themselves, not to DCE/DTE sides of the line. (Compare with the OR/IND field, below.)

Selecting OR causes triggering if any of the three strings appears on the link; selecting AND causes triggering only when all three strings appear--as if the trigger were one long string.

A fourth selection is given for STOP STRINGS when monitoring HDLC or SDLC: "FLAG." Selecting "FLAG" forces stop triggering on the frame's closing flag.

OR/IND Field

The reverse video field between the DTE and DCE sides may be toggled between OR and INDependent. The default condition is OR.

If set to IND, then the sides operate independently; that is, DTE data is logged into the capture buffer only between DTE start/stop triggers, and DCE data is logged only between DCE triggers. If start/stop triggers are specified for only one side of the line, then all transactions on the other side are logged into the buffer.

When set to OR, any trigger starts or stops data logging for both sides. Also, the "pre-trigger" operates.

The "Pre-Trigger"

In synchronous BOP or BCP a start trigger often occurs several bytes into the frame or block--within the address section of a call request or incoming call packet, for example. Unless the "pre-trigger" bytes (the first bytes of the frame) are saved, the frame cannot be analyzed by the 801B's ANALYZE function.

For this reason CXR Telcom developed the unique "pre-trigger," which operates when two conditions are met:

1. The OR/IND field is set to OR, and
2. the 801B is monitoring a synchronous BCP or BOP.

When the pre-trigger is operating, the run mode display shows only the data that occurs between triggers. The capture buffer, however, contains all of the characters of the frame or block containing the start trigger, including the opening flag or sync character. The last character of the start trigger is marked with the blinking underline.

Trigger Strings

Three data entry fields are provided. (Remember: press [CLEAR], make your entries, then press [ENTER].)

Async, Sync, and BCP Trigger Strings:

For byte-controlled or async protocols, the three trigger fields are labeled A STRING, B STRING, and C STRING. You may enter up to eight characters (in hexadecimal) for either side of the line for each of the three strings. The "don't care" character is a legal entry at any character position.

The A, B, and C strings operate in a logical OR or AND for triggering, depending on your START STRING selection. Note that selecting "AND" for the START STRINGS field enables you to have a start string exceeding eight characters in length.

HDLC and SDLC Trigger Strings:

For HDLC and SDLC the three trigger strings pertain to the address, control, and information fields of the protocol: A (address) FIELD BYTES, C (control) FIELD BITS, and I (information) FIELD BITS. Moreover, the STOP STRINGS field contains the extra choice, "FLAG." In this case the closing flag of the frame is the stop trigger.

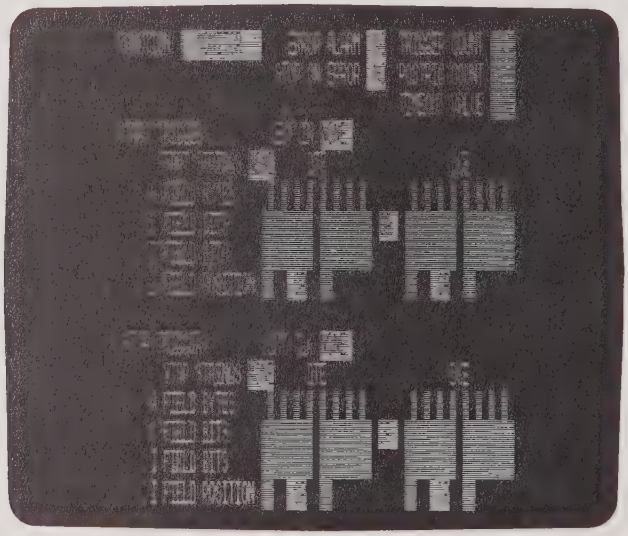


Figure 3-7. HDLC/SDLC Start/Stop Page

## A FIELD BYTES

The A field is one byte (or "octet") long; the 801B permits you to enter up to eight bytes in the A FIELD BYTES string. Two or more bytes operate in an "OR" configuration. Enter the A FIELD BYTES string in hexadecimal.

## C FIELD BITS

The C Field is one byte long; however, two bytes--in binary--may be entered in the C FIELD BITS string. The two entries are ORed. Making the entries in binary simplifies entering the "don't care" character for the poll or final bits, send/receive sequence numbers, and other bit fields. The only legal keystrokes for binary entries are "1", "0", and "X" ("don't care"). For example, in HDLC protocol (X.25), specifying

X X X X 0 0 0 1

as the C FIELD BITS string causes the 801B to trigger on any RR (receiver ready) frame.

## I FIELD BITS_/_POSITION

The I Field in bit-oriented protocols is of variable length, and contains important information for packet switching. You can specify two bytes at any position within the I-field by using the I FIELD BITS and POSITION fields. The AND/OR field between the POSITION fields governs the I FIELD BITS strings. If set to AND, triggering occurs when both of the I FIELD BITS strings occur in the transmission. If set to OR, triggering occurs whenever either occurs.

You may specify up to two I FIELD BITS fields for either side of the line. The entries are in binary; the "don't care" character is legal in any bit postition.

The POSITION value (1 to 99) associated with the I FIELD BITS string points to the particular octet in the I Field. Specifying

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I FIELD BITS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | | X | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| POSITION: | 21 | | | | | | | | AND | | 24 | | | | | | | |

causes the 801B to trigger if the 21st byte in the I field is a :01 and the 24th byte is :33 or :F3 (note the use of the "don't care" character.) Also, the value in the second POSITION field must be greater than the first.

More detailed examples are given in Application 3-9.

To review the several "AND/OR" configurations for triggering: if the START/STOP STRINGS field is set to AND, then triggering occurs when

(A1 or A2 or A3 ... or A8) AND (C1 or C2) AND (I1 <and/or> I2),

where A1, C2, I2, etc., refer to A FIELD BYTES, C FIELD BITS, and I FIELD BITS.

If START/STOP STRINGS is set OR, then

(A1 or A2 or A3 ... or A8) OR (C1 or C2) OR (I1 <and/or> I2).

### Stop Trigger Function

The stop trigger functions are identical to those of the start strings. Remember that the front panel CLK input can be used as a stop trigger.

### ERROR ALARM Field

Allowable selections are YES and NO. Selecting YES causes the 801B to beep when it encounters an error. At least one error counter must be enabled for this function to operate.

### PAGE 3: System Counters

Basically, the COUNTER page records the number of errors and start/stop triggers for both sides of the line.

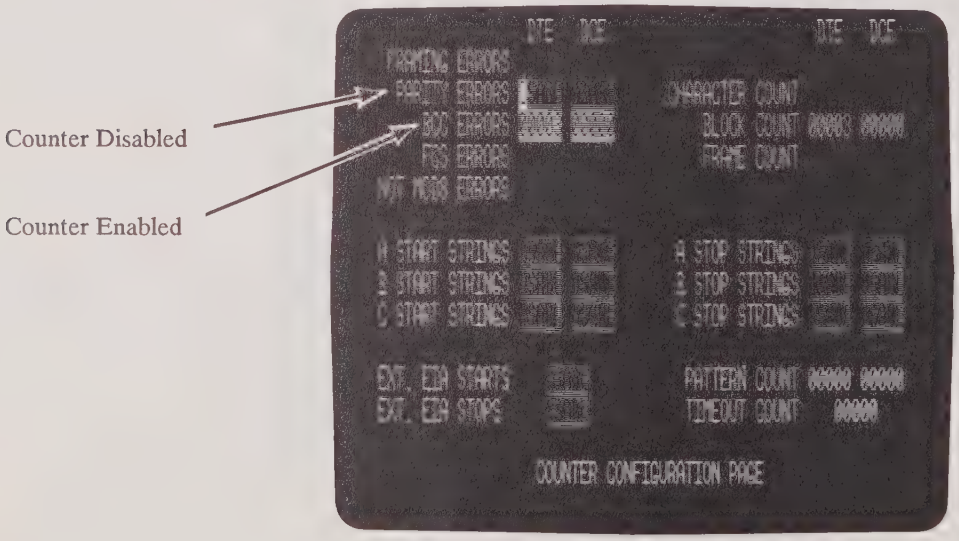



Figure 3-8. The COUNTER Page

The upper left-hand column provides counters for FRAMING, PARITY, BCC, FCS, and NOT MODulo 8 errors. In figure 3-8 above, the 801B provides only the PARITY and BCC error counters, since in this case the system was monitoring SYNC protocol. In this example the operator enabled the BCC counter only, and three BCC errors have occurred on the DTE side of the line. We don't know how many parity errors (if any) occured, because the PARITY error counter is disabled.

The "... STRINGS" fields enable you to count starts and stops on various strings. Note that all of the counters are reset when you press [RUN].

Continuing down the right column: the EXT EIA STARTS/STOPS counters should be, by now, self-explanatory.

The CHARACTER, BLOCK, and FRAME COUNT fields (upper left corner of the display) operate automatically. The CHARACTER counter is enabled under async protocol when either the FRAMING or PARITY error counter is enabled, and the BCC counter is disabled. BLOCK COUNT operates under both async and sync protocols (a block is determined by an <ETX> character in the data stream); FRAME COUNT operates under HDLC or SDLC.

PATTERN COUNT (lower left corner) counts occurrences of the string(s) entered in the PATTERN MATCH field on PAGE 1. TIMEOUT COUNT operates during the TIMEOUT STOP function (see Sec. 3.8).

### Enabling/Disabling the Counters

Call up PAGE 3. Select the counter to be enabled/disabled by placing the cursor in the field opposite the counter, and press [ENTER]. Note that there are two fields for each counter--one for the DTE side, and the other for the DCE side of the link. The counter toggles between "DSABL" in dim reverse video, and "00000" in bright reverse video, indicating that the counter is enabled. The maximum count in each field is 65,535.

The CHARACTER, BLOCK, FRAME, PATTERN, and TIMEOUT counters are always active. Counts accumulate in these fields if you have made the applicable selections on PAGE 1 and/or PAGE 2. After capturing data, press [PAGE 3] to display the counters.

We return now to the discussion of the START/STOP page.

### STOP ON ERROR Field

Press [ENTER] to select YES or NO. At least one ERROR COUNT field must be enabled (PAGE 3) for the STOP ON ERROR function to operate. Once selected, this "stop function" is always active (it's ORed with the other stop triggers).

### TRIGGER COUNT Field

In the run mode, the 801B can start and stop continuously, or any number of times up to 9,999, depending on the TRIGGER COUNT value. Setting TRIGGER COUNT to zero or null enables continuous operation; setting it to, say, 10, causes the 801B to start/stop 10 times; it then enters the capture mode.

TRIGGER COUNT is a four-digit "data entry field;" press [CLEAR] to open the field, then enter a number (using the number keys 0-9), then press [ENTER]. (If four digits are entered, it is not necessary to press [ENTER].) If you press a key other than the digits 0-9 or [ENTER], the 801B beeps and displays "ERROR 0C". To recover, simply press the right key, or [ENTER]. Then re-enter the TRIGGER COUNT value, if necessary.

### POST-TRIGger COUNT Field

Entering a value between 0 and 9999 in this "data entry" field permits logging and display of a total of up to 9,999 characters, from both sides of the line, following the occurrence of the stop trigger.

> Note: the POST-TRIG value can exceed the capacity of the capture buffer. Use care in choosing a POSTRIG COUNT value to avoid a capture buffer "wraparound" (which would cause the triggering data to be overwritten and lost).

### TIMEOUT VALUE Field

The field is used in conjunction with the TIMEOUT-STOP function, described under Sec. 3.8, below. Enter a time, in seconds, to be used as a stop trigger. This time is measured from the occurrence of the start trigger. No entry (or entering 0000) results in continuous operation. Entering a timeout value also enables the timeout counter on the counter configuration page.

## Application 3-5. Start/Stop Function: General

This example is written under the assumption that you are monitoring an active asynchronous link, as in Application 3-1, above.

1. Set up the 801B to monitor the link.

2. Press [PAGE 2], move the cursor to the START STRINGS: field, and repeatedly press [ENTER] to select OR.

3. Move the cursor to the A STRING field, press [CLEAR], then enter any known or common one- or two-character string that regularly appears on the link. Make the entry in hexadecimal. For example, you might enter "E" (:45) or "e" (:65) as a start string. Terminate the string by pressing [ENTER].

4. Move the cursor to the STOP STRINGS field, and select OR.

5. Select a common character as a stop string, for example, <return/linefeed> (:0D, :0A).

6. Press [RUN] and observe the results. Notice that only the data occuring between triggers are displayed. Press [CAPTURE] when you are ready to continue with step 7.

7. Experiment with the following:

   - Enter a TRIGGER COUNT--say, 10. Note that the 801B enters the capture mode after 10 starts/stops. Press [RUN] to resume monitoring, [CAPTURE] to stop.
   - Enter the strings on different sides of the link.
   - Retaining a single stop string (on either side of the link), enter separate start strings in the A STRING and B STRING fields. Note the effect of the AND, OR, and NONE selections in the START STRINGS field.
   - Enter various start/stop triggers on both sides of the line. Experiment with the OR/IND field.
   - On PAGE 3, enable the counters that correspond to the triggers. Find out how many times the link starts/stops on each string or condition.

## Application 3-6. Capturing Data Transmissions Only

Note: this and the next application use the "DON'T CARE" character (displayed as a dim video "X").

Problem: You don't want to clutter the capture buffer with numerous polls and "no data" replies, but rather to capture data transmissions only.

Sync and Async Protocols:

1. Set the 801B to start on the beginning bytes of a data transmisison: <SYN>, <STX> (:32, :02). Note: for transparent sync transmissions, start on <SYN>, <DLE>, <STX> (:32, :10, :02).

2. Stop on <ETX>, X, X, X. Using the DON'T CARE character causes the 801B to continue monitoring for three more characters after it encounters the <ETX> (which is the actual stop trigger). By doing so, the 801B stores the <ETX>, two <BCC> characters, and the closing flag of the synchronous transmission.

For transparent sync, stop on <DLE>, <ETX>, X, X, X.

Bit-Oriented Protocols: See Application 3-8, below.

## Application 3-7. Monitoring Select Stations on a Multidrop Link

Sync (or Byte-Controlled) Protocol:

1. Set the START/STOP STRINGS field to OR.

2. For the start trigger, specify the opening flag, the two-byte Station Select Address, the two-byte Device Address, and the <ENQ> character, viz: <SYN><adr><adr><dev><dev><ENQ>. Using the A, B, and C start strings, with the START STRINGS field set to "OR", you can monitor up to three stations.

3. Stop Trigger: as required. You may, for example, set the system to stop on the first data response from the other side:

<ETX> X X X

Bit-Oriented Protocol: See Application 3-8, below.

## Application 3-8. BOP Start/Stop Strings

The following is given only as an example; your actual setup must be tailored for the specific application. This example (monitoring an X.25 link) captures all DTE data packets.

1. On the DTE side, set up the following trigger:

   a. Set the START STRINGS field to AND.

b. A FIELD BYTES: X (don't care).

c. C FIELD BITS: X X X X X X X 0. Here, the 801B "looks for" a zero in the LSB position. The zero indicates that this is an information frame.

d. The first I FIELD BITS field (POSITION = 1), "looks for" a zero data-qualifier bit (which indicates that this is a user-data packet):

0 X X X X X X

(Optional.) To trigger on packets addressed to a specific logical channel number (LCN):

0 X X X y y y y

where "yyyy" is the bit-pattern of the LCN.

(Optional.) To trigger on a packet addressed to a particular logical channel group number (LGCN), enter:

y y y y y y y y

where "y ... y" is the LGCN, in binary. Specify POSITION 2.

e. For the second I FIELD BITS field specify AND, then POSITION 3, and enter the following bit string:

X X X X X X X 0

The LSB zero here means that this I Frame contains a data packet. Bit 5 (underlined in this text) is the more-data bit. A zero in this position causes triggering on the last data packet in a particlar interchange.

With this setup, the 801B starts monitoring only when a DTE data packet crosses the link.

2. In the STOP STRINGS: field, select "FLAG".

## 3.8 OTHER START-STOP FUNCTIONS

### Timeout-stop Function

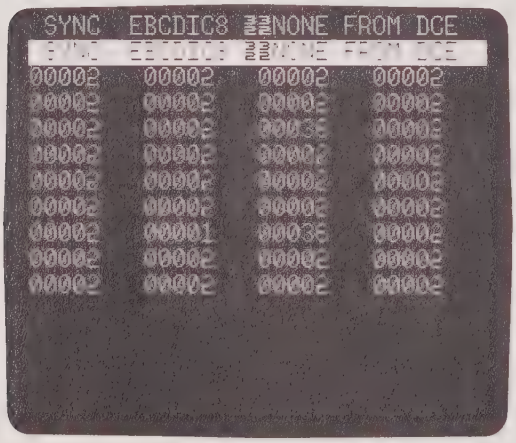
"Timeout" is just another type of stop trigger. When the timeout-stop function is enabled, the 801B monitors the link until it encounters a stop trigger, or until the TIMEOUT VALUE expires. Timeout is measured from the occurrence of the start trigger.

### Application 3-9. Timeout-Stop

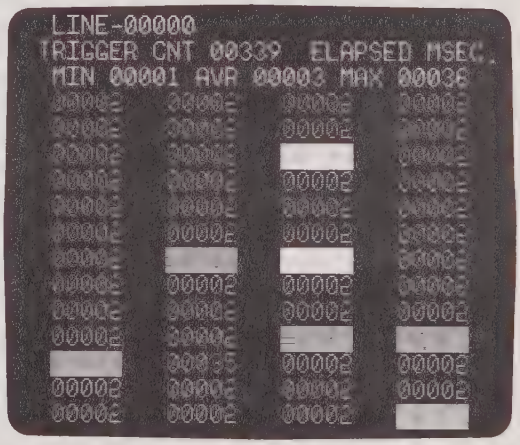
Select TIMEOUT-STOP in the FUNCTION FIELD, and select a TIMEOUT VALUE from 1 to 9999 seconds. Then set up both start and stop triggers, and press [RUN]. If the stop trigger fails to occur within [TIMEOUT VALUE] seconds after the start trigger, the 801B times out (stops logging) and enters the capture mode, or resumes searching for the start trigger, depending on the setup.

### Elapsed Seconds or Milliseconds

Selecting the elapsed time functions causes the 801B to measure and display the elapsed time between the occurrence of the start and stop triggers. In this case traffic from the interface is neither logged into the capture buffer nor displayed on the screen. Instead, the time (in either seconds or milliseconds) is logged and displayed. See figure 3-9, below.




RUN Mode




Capture Mode

Figure 3-9. PAGE 0, Elapsed Time Function

The time between each pair of triggers is displayed, one line at a time, from left to right and from top to bottom. Display of the values continues until the capture buffer is full (or until you press [CAPTURE]). At this time the 801B automatically enters the capture mode.

In the capture mode, the top two lines on the screen display the trigger count, elapsed time function (seconds or milliseconds), and the minimum, average, and maximum time values measured. The remainder of the screen displays the recorded time measurements. The [SCROLL-up] and [SCROLL-down] keys are operative.

The elapsed time measurements are displayed as follows:

| | |
|---|---|
| Bright intensity, blinking video: | Maximum time |
| Normal intensity, blinking video: | Minimum time |
| Normal intensity, reverse video: | Average time |
| Normal video: | All remaining time measurements |

## Application 3-10. Measuring Response Time

In certain applications (e.g., monitoring satellite communications links) it may be necessary to measure the link's response time. This example assumes that the link operates under X.25.

1. After configuring the 801B to match the link (PAGE 1 selections), make the following selections on PAGE 2:

| | |
|---|---|
| FUNCTION | ELAPSED SEC |
| START STRINGS: | AND<br>(DTE side) |
| A STRING BYTES | X (any frame) |
| C FIELD BITS | (null) |
| I FIELD BITS | (null) |
| POSITION | (null) |
| STOP STRINGS: | AND or OR<br>(DCE side) |
| A STRING BYTES | X (triggers on the next DCE frame.) |

Note: You may also measure the system response to various commands. The start/stop strings must be entered on opposite sides of the link, for example. The following table gives examples of C FIELD BITS strings.

| Cmd. | Start | | | | | | | | Cmd. | Stop | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SARM | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | UA | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | |
| SABM | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | UA | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | |
| RNR | X | | X | | X | | 1 | 0 | | 1 | 0 | 1 | RR | X | | X | | X | 1 | 0 |
| 0 | 0 | 1 | | | | | | | | | | | | | | | | | |

2. Press [RUN]. The system now measures the time it takes the link to respond to the specific start trigger.

Elapsed Character Function

The elapsed character function is similar to the elapsed time functions, except the 801B counts and displays the number of characters between triggers. The function continues until the capture buffer is full or until you press [CAPTURE]. The maximum count is 65,535.

The run mode and capture mode displays are almost identical to the elapsed time functions. In the capture mode, the first two lines show the trigger count, the function, and the minimum, average, and maximum character counts. The counts between each pair of triggers are displayed on the rest of the screen as follows:

| | |
|---|---|
| Bright intensity, blinking video: | Maximum character counts |
| Normal intensity, blinking video: | Minimum character counts |
| Normal intensity, reverse video: | Average character counts |
| Normal video: | All remaining character counts |

## Application 3-10. Determining the Size of Data Blocks or Packets

This counts the number of characters in X.25 data frames.

1. After making the appropriate setup on PAGE 1, make the following selections on PAGE 2:

| | |
|---|---|
| FUNCTION | ELAPSED CHAR |
| START TRIGGER: | |
| EXT IN | NONE |
| START STRINGS | AND |
| A STRING BYTES | X |
| C FIELD BITS | X X X X X X X 0 |
| I FIELD BITS | 0 X X X X X X X X X X X X X X |
| POSITION | 1 AND 3 |
| STOP TRIGGER | |
| CLK | NONE |
| STOP STRINGS | FLAG |

2. Press [RUN].

## 3.9 SELF-TESTS

### Automatic Self-Tests

When the 801B is turned on, the CRT displays "INITIALIZING," indicating that the system is performing a series of self-tests. These tests include a PROM CRCC test, a processor timer test, a processor RAM test, and an extension RAM test. Should any errors occur, the instrument displays the offending self-test page with the error identified. Upon passing the self-test, the 801B displays the page selection menu.

### Self-Test Mode

To select the self-test mode, press [RESET], then press [CLEAR]. The self-test menu then appears. The menu offers three self-tests in addition to the four listed above: video RAM test, write/read RAM loop test, and keypad/video display test.

801B SELF TEST MENU
ENTER TEST#

1 REVISION REPORT
2 PROCESSOR TIMER
3 SYSTEM RAM
4 LOOPBACK
5 VIDEO RAM
6 WRITE/READ RAM LOOP
7 KEYPAD/VIDEO DISPLAY

PRESS [CLEAR] TO TERMINATE TEST
PRESS [RESET] TO ENTER MONITOR

On the keypad, enter a test number from 1 to 7, or press [CLEAR] (which terminates any ongoing test and returns the self-test menu), or [RESET] (which returns the 801B to the monitor mode).

Pressing any other key may produce unpredictable results.

### Test #1 - REVISION REPORT

The revision report displays the software level and its release date, and the checksums for the system (EPROM) and user programs (EEPROM). The last line lists the installed options.

### Test #2 - PROCESSOR TIMER TEST

This routine tests the system's various timers. If the 801B passes the Timer Tests, "TEST COMPLETE" is displayed; otherwise, error messages are displayed. Report these messages to your nearest CXR Telcom Service Center.

### Test #3 - SYSTEM RAM

This routine writes a byte to each address in the processor's scratch pad, then reads the byte back. Each time the scratch pad is written/read, the pass count (PASCNT) is incremented. The test continues until you press [CLEAR] or [RESET]. Any read/write errors are displayed in the error count (ERR CNT) field, with a description of the error below.

ADDRess shows the address of the bad read/write operation; the next two columns give EXPected and ACTual values read from the memory.

### Test #4 - LOOPBACK TEST

Not implemented.

### Test #5 - VIDEO RAM

This routine tests video RAM, and is similar to Test #3 above, except that the user must specify the address block to test.

### Test #6 - WRITE/READ RAM LOOP

The user is asked to enter the address of the suspected bad memory. The processor then asks for a byte to be continually written/read from the address location. The "TEST IN PROGRESS" message means what it says; report any other error messages to the CXR Telcom Service Center.

Note: Use this routine to set the CRT to 50 or 60 Hz operation. In the address field, enter E800. Writing the value :50 sets the CRT to 50Hz operation; any other value, to 60Hz.

### Test #7 - KEYPAD/VIDEO DISPLAY

This routine tests the character sets for the DTE (normal video) and DCE (reverse video) capture buffer. On the top right of the display, seven shades of video gray provide a reference for adjustment of the CRT brightness and contrast. (On color monitors, these fields are in color for hue and tint adjustment.) The characters "FLH" flash in reverse video to test the reverse video; on the right, the #3 CURsor field flashes to demonstrate operation of the flashing cursor.

Pressing [CODE/HEX] causes the character set to be displayed in hexadecimal. Pressing [ENTER] causes the CHARACTER SET field to cycle through the available transmission codes: EBCDIC (default), ASCII, SELECTRIC, IPARS, EBCD-2740, SBT, and BAUDOT.

Each front-panel key is assigned a 2-byte (4 hex digits) code. Pressing any key (except [RESET] and [CLEAR]) causes the 2-byte code to be displayed in the KEYCODE VALUE field to test keyboard operation.

# SECTION 4 - PRINTER / POLL / BIT-ERROR-RATE TEST

## 4.1 GENERAL

Printer/Poll/BERT-II enables an operator to:

- o Perform Bit Error Rate Testing (BERT).
- o Output the contents of the display buffer to a printer or remote device.
- o Perform interactive polling and responding to poll in ASYNC, SYNC, IPARS, SDLC or HDLC protocols.

In general, operating the 801B with Printer/Poll/BERT-II (PPB-II) is identical to normal operating procedures. With PPB-II, pressing [PAGE 4] calls up the PPB (Printer/Poll/BERT) page. The PPB page in turn produces four more pages (or displays): the Poll PROGRAM page, the Poll MENU page, the PRINTER page, and the BERT page. See Figures 4-1 through 4-4.

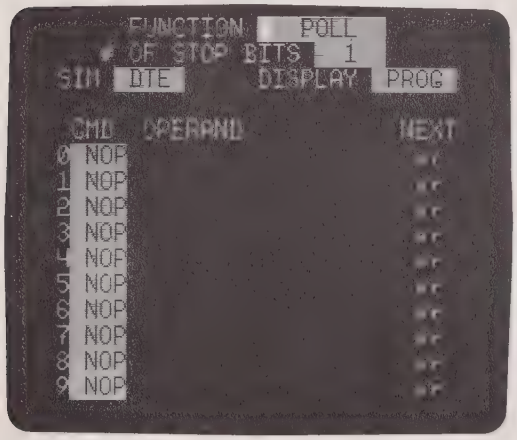



Figure 4-1. Poll PROGRAM Page

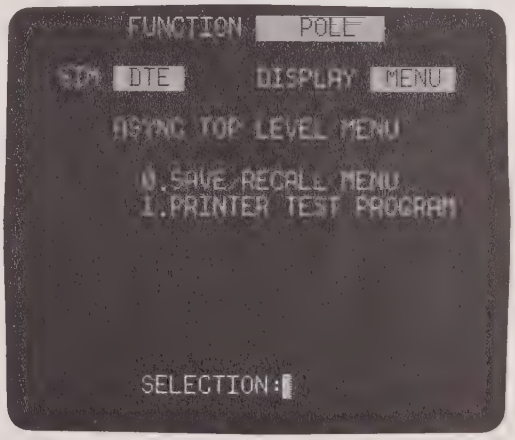



Figure 4-2. The Poll MENU Page

(Both examples: Asynchronous 7-bit ASCII)

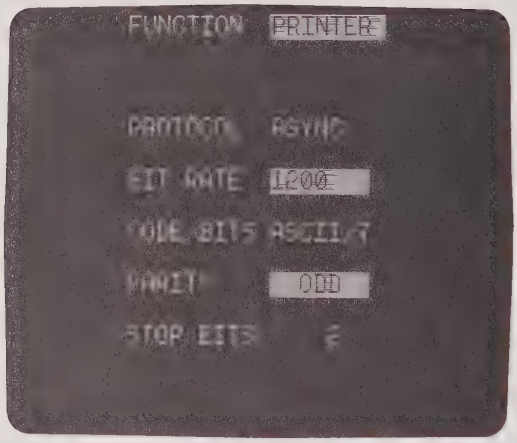



Figure 4-3. Printer Page

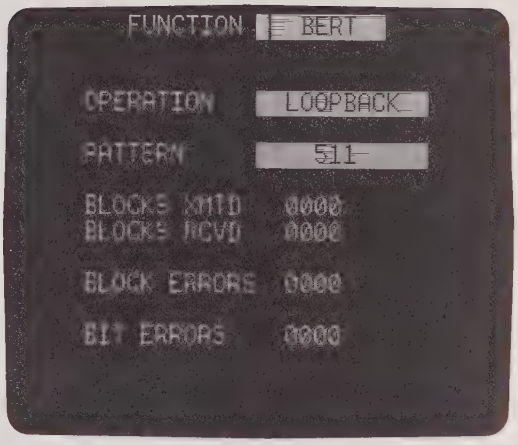



Figure 4-4. BERT Page

(Both examples: Asynchronous 7-bit ASCII)

## 4.2 THEORY OF OPERATION

### Interconnection

PPB-II causes the 801B to transmit, rather than merely passively monitor, data. As a transmitter, its EIA interface can simulate either DCE or DTE. For this reason, connections are simple and easy: connect the output device (printer, modem, terminal, etc.) to the rear-panel EIA connector, then set the front panel SIM DCE or SIM DTE switch as required.

### Printer/Poll/BERT-II Functions

After the PPB page is selected, the operator can initiate a Printer operation (hardcopy CRT display), Poll (or respond to poll), or Bit Error Rate Test (BERT).

Printer. The printer function enables the contents of the display buffer to be output to an asynchronous printer (or other remote device). If the data is to be output to a printer, the printer should have the capability of printing the full ASCII character set (both upper and lower case).

Bit Error Rate Test (BERT). In this function, the user can select a preprogrammed pattern of 511 or 2047 bits to be transmitted or received. The test pattern can be repeated up to 9999 times, or can be run continuously. During the BERT test, the 801B can either transmit, receive, or operate in a loopback configuration to test the data link. BERT is accessible in SYNC and ASYNC protocols only.

Poll. In this mode, the 801B can be programmed to poll, or respond to poll, in all protocols. Essentially, this means that the 801B can be programmed to output or respond to specific messages or data, to or from a variety of devices. The 801B can be set up for polling in all protocols except DDCMP.

Transmitted messages may be up to 16 characters in length. For ASYNC, SYNC, and IPARS protocols, up to 8 characters may be "received;" that is, compared with the incoming data from the link. Should the data off the link match the receive string, the program advances to the next statement. For HDLC and SDLC protocols, the RECV string is 16 bits ("1" or "0") long, and all 16 bits must be defined.

The 801B monitors the data link during the polling or responding operation, storing the link transactions in the capture buffer. Note, however, that start/stop strings, triggers, and suppress text/characters are not user-alterable during PPB-II operations.

## 4.3 BERT (BIT ERROR RATE TEST) FUNCTION

The Bit-Error-Rate Test (BERT) helps determine the transmission quality of both asynchronous and synchronous data links. In this function the 801B operates as DTE in either asynchronous or synchronous protocols, transmitting test patterns of either 511 or 2047 bits. The 801B can be set up to transmit, receive, or loopback. To perform BERT testing, proceed as follows:

1. Set the front panel switch to SIM DTE.

2. Connect the rear-panel EIA connector to the modem on the data link being tested.

3. On PAGE 1, select ASYNC or SYNC protocol as required (the BERT page is suppressed if any other protocol is chosen).

4. In the BIT RATE field, select:

   | | |
   |---|---|
   | ASYNC Protocol: | The applicable bit rate. |
   | SYNC Protocol: | FROM DCE. |

5. The BERT test can be run continuously, or from 1 to 9,999 times. To perform a specified number of BERT tests, press [PAGE 2], position the cursor in the reverse video TRIGGER COUNT field, press [CLEAR] to delete any existing value and to open the selection, and enter the desired count. Press [ENTER] to terminate the selection if less than four digits are entered.

6. Press [PAGE 4] to display the Printer/Poll/BERT page, position the cursor in the FUNCTION field, and press [ENTER] until BERT appears.

7. Position the cursor in the reverse video OPERATION field and press [ENTER] to select TRANSMIT, RECEIVE, or LOOPBACK as required.

   If TRANSMIT or RECEIVE is selected, you need to have an 801B or comparable BERT tester at the other end of the data link in order to perform the test. If LOOPBACK is selected, the loopback connection must be accomplished at the remote end of the link.

8. Place the cursor in the PATTERN field and select 511 or 2047 bits.

9. Initiate the test by pressing [SEND]. The test continues until the trigger count is complete or [CAPTURE] is pressed. At this time the number of blocks transmitted, number of blocks received, number of blocks containing errors, and the total number of bits in error are displayed. Any blocks received that contain more than 20 errors are discarded and not counted as received.

## 4.4 PRINTER FUNCTION

The PRINTER function permits the 801B to transmit the contents of the display buffer to a remote device. "Remote device" usually means an asynchronous printer capable of producing the full ASCII character set.

The 801B may be configured as DTE or DCE. The data output is asynchronous 7-bit ASCII, with two stop bits. The bit rate and parity are "selectable." To perform the PRINTER function, proceed as follows:

1. Monitor and capture the data off the link. (The 801B must be in the CAPTURE mode.)

2. On the 801B rear panel, disconnect the link from the EIA connector, and connect the printer or remote device in its place.

3. On the front panel, rotate the switch to SIM DCE (if a printer is connected), or SIM DTE (if connected to a modem).

If connected to a modem, establish a connection to the remote device.

If the device has a non-standard interface, jumper the breakout box as required.

4. Press [PAGE 4], calling up the PPB page. Place the cursor in the FUNCTION field and press [ENTER] until PRINTER appears.

5. Move the cursor to the BIT RATE field, and press [ENTER] to select a transmission rate from the following:

   50, 75, 100, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, or 9600 bits per second.

6. Move the cursor to the PARITY field and select ODD, EVEN, or NONE.

The 801B is now ready to transmit the contents of the display buffer. Simply press [PRINT]; the current display is transmitted. Pressing any other key (after printing commences) halts the operation. If PAGE 0 (the capture buffer) is the current display, the entire capture buffer from the current line number is output.

Note: the 801B may not output the data to the printer if certain EIA leads are not asserted. Simply press [ENTER] to override this condition. See "Missing EIA Leads" under Sec. 4.6 below.

Print Format

Each line in the printout contains the same number of characters as a display line. Four lines are printed for each display line.

The first line identifies the data attributes of the characters underneath as follows:

| | |
|---|---|
| -- - | <underline> indicates DCE (or reverse video) data |
| N or n - | No Data |
| P or p - | Parity Error |
| F or f - | Framing Error |
| O or o - | Overrun Error |
| B or b - | BCC (or FCS) Error |
| C or c - | Cursor Position |
| G or g - | No Error |

DTE attributes are printed in upper case letters; DCE in lower case.

The second line in the printout contains either:

the alphanumeric (printable) characters from the data, or
the first digit of a hexadecimal character, or
the first character of any control character abbreviations.

The third line contains:

the second digit of any hexadecimal characters, or
the second character of any control character abbreviations.

The fourth line, blank, serves as a data separator.

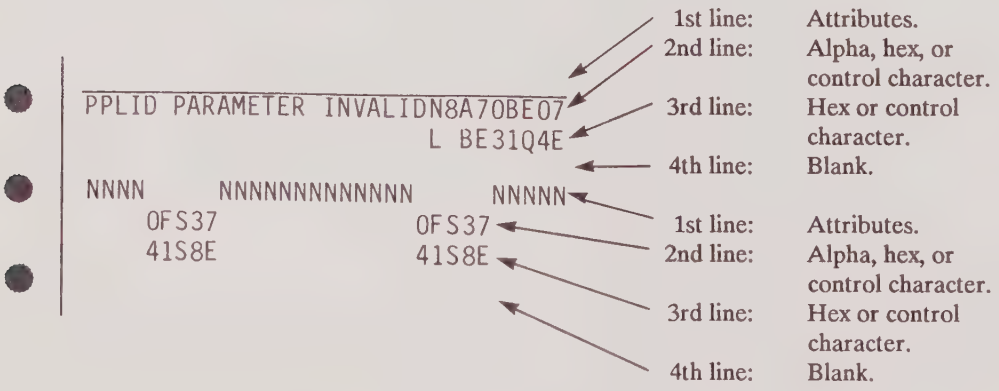



Figure 4-5. Printer Output

## Application 4-1. Dumping Data from Capture or Setup Pages to Remote 801B

Essentially, the receiving 801B simulates a printer. Set up the receiving 801B's DISPLAY SIZE field (PAGE 1 parameter) to 32x16 or 64x16 to match that of the transmitting 801B.

| Local 801B SIM DTE | Modem DCE | Modem DCE | Remote 801B MONITOR |
|---|---|---|---|

1. Set up Local (transmitting) 801B per page 4-4.

2. Set remote (receiving) 801B to suppress characters :0D <carriage return> and :0A <linefeed>.

## 4.5 POLL FUNCTION -- GENERAL

The polling programs cause the 801B to act as a DCE or DTE, and to transmit and receive specific data strings. You can run your own program, use any of the default programs, or edit a default program to meet your particular needs. Also, you can save up to seven of your programs for later use.

After you have set up the 801B to match the link or device to be tested, press [PAGE 4] to bring up the PPB page. The first three lines of the page displays three (or four) reverse video fields: FUNCTION, (# OF STOP BITS), SIMulate, and DISPLAY.

FUNCTION: Place the cursor in this field and press [ENTER] to select POLL. The page format changes when PRINTER or BERT is chosen.

SIM: (Simulate.) Using the [ENTER] key, choose DTE or DCE.

(# OF STOP BITS): This field appears if you have selected an asynchronous protocol (on PAGE 1). Press [ENTER] to select 1, 1.5, or 2 stop bits.

DISPLAY: Place the cursor in this field and press [ENTER] to select PROGram (default) or MENU. Under PROGram, the remainder of the page shows the ten possible statement lines for your polling program.

When MENU is selected, the remainder of the CRT changes to display a list of default polling programs, and causes the cursor to move to the SELECTION field at the bottom of the page. The list of default programs is different for each of the PROTOCOL selections made on the PAGE 1. (Appendix E describes all of the default programs.)

SELECTION: This field appears at the bottom of the Poll MENU page. Place the cursor in the field (if it is not there already) and choose one of the menu selections by pressing a number key. It is not necessary to press [ENTER]. If you press the wrong key, return the cursor in the DISPLAY field, and press [ENTER] to recall the menu.

The remainder of the text in this section provides:

- detailed operating instructions for polling programs
- detailed descriptions of polling program commands and operands
- examples of two default programs.

Note: The following paragraphs are written with the assumption that you have gained a basic familiarity with the basic operating procedures for the 801B.

## 4.6 INSTRUCTIONS - POLLING

This subsection gives detailed instructions on programming the 801B to poll and respond to poll.

Note: If you make a logical error in your polling program, the 801B displays an error message when you press [SEND].

Initial Setup

1. Connect the 801B to the device or link to be tested. On the front panel of the 801B, rotate the switch to SIMulate DTE or SIM DCE as required.

2. On PAGE 1, select the protocol, bit rate, transmission code, etc., to match the link or device to be tested. (In sync protocols: if the front panel switch is set to SIM DTE, then select FROM DCE as the bit rate; if set to SIM DCE, then select an internal rate.)

3. Press [PAGE 4] to call up the PPB page. Make the following entries:

   a. FUNCTION: POLL

   b. If in ASYNC, enter the # OF STOP BITS required by the device or link to be tested.

   c. In the SIM field, select DCE or DTE. This selection must match the front panel's SIM DTE or SIM DCE switch setting.

Loading a Default or Stored Program

Place the cursor in the DISPLAY field and press [ENTER] to select MENU. The TOP LEVEL MENU for that protocol appears, and the cursor jumps to the SELECTION field at the bottom of the page.

1. To load a default program:

   a. Ensure that the cursor is in the SELECTION field; then press a number key to make the selection. The display returns to the poll program page, the cursor returns to the DISPLAY field, and the selected program appears.

   b. If desired, edit the program as described in "Manually Editing or Entering a Program," below.

2. To load one of your saved programs:

   a. The main menu (called the "TOP LEVEL MENU") begins with the selection, "0. SAVE/RECALL MENU." The SAVE/RECALL MENU is the same for all protocols.

      Place the cursor in the SELECTION field, and press the "0" (zero) key, calling up the SAVE/RECALL MENU.

   b. When the SAVE/RECALL menu appears, press the number key [2], instructing the 801B to "LOAD USER PROGRAM". The 801B then prompts you to enter a number from 1 to 7 -- the number of your stored program. The display returns to the poll program page, with the cursor in the DISPLAY field; your selected program appears.

Manually Editing or Entering a Program

Note: detailed descriptions of the commands, their operands, and their NEXT fields appear in Sec. 4.7, below.

1. Place the cursor in the CMD (command) field for the line to be entered or edited, and press [ENTER] until the desired command appears. The commands are:

| | | | |
|---|---|---|---|
| XMIT | Transmit | RECV | Receive |
| TOUT | Time out | CNT | Count |
| NOP | No operation | END | |

The operand field changes for each command.

2. The OPERAND field is a "data entry" field. For the XMIT, RECV, TOUT, and CNT commands, place the cursor in the operand field, press [CLEAR] to delete the existing entry and open the field, then, using the hexadecimal keypad, enter the desired string. Terminate the entry by pressing the [ENTER] key.

3. The cursor moves to the left-hand NEXT field. Press [CLEAR], then enter a number between 0 and 9.

The cursor advances to the right-hand NEXT field. An entry in this field is optional--see Sec. 4.7, below.

4. Repeat steps 1. through 3. until the program is complete.

Storing the Program

1. Place the cursor in the DISPLAY field, and press [ENTER] until MENU page appears.

2. In the SELECTION field, press "0" (zero). The SAVE/RECALL menu appears.

3. Press [3] (SAVE USER PROGRAM). The system them prompts you to enter a program number between 1 and 7. After you enter the program number, the screen flashes "WAIT" until the program is written.

4. Then select [1] to return to the top level menu, or move the cursor to the DISPLAY field and press [ENTER] to return to the program page.

## Running the Program

Simply bring up the PPB program page, then press [SEND]. The 801B starts executing the program, beginning at line #0, and the CRT displays the monitor page.

Note: press [SEND] from the PPB page only; pressing the [SEND] key from the capture or setup page produces an error condition.

After you press [SEND] the 801B brings up the run mode display (PAGE 0). The display looks exactly the same as the normal run mode display, except that a "P" is printed on the upper right corner of the CRT in the DCE or DTE status line. A "P" in the DTE line (top) shows that the poll program is simulating a DTE; in the DCE line, a DCE.

The program continues to run until

1. [CAPTURE] is pressed.

2. An END statement is executed.

## Missing EIA Signals

Sometimes the poll program won't run, because the other device fails to assert the proper EIA RS-232-C leads. In this case the 801B prints the unasserted lead numbers in blinking video. You can override this condition in two ways:

1. Connect a jumper from the front panel breakout box's +12V or -12V sources to the missing pin, thus supplying the missing signal; or

2. Press [ENTER], which simply overrides the condition, causing the 801B to "send" anyway.

## 4.7 PPB COMMANDS, OPERANDS, AND "NEXT" STATEMENTS

On the PPB-II program page, the lower two-thirds of the display contain the following fields (from left to right):

Line number. This field is preprogrammed, and may not be changed.

CMD (Command) Field. This "selectable" field has six allowable entries:

| | | | |
|---|---|---|---|
| XMIT | Transmit | RECV | Receive |
| TOUT | Timeout | CNT | Count |
| NOP | No Operation | END | End |

Operand Field. The operand differs both with the command and the protocol. See tables 4-1, below.

Next Field. After the command and operand fields have been executed, the NEXT field(s) directs the program to the next statement line to be executed. One or two NEXT fields may be specified according to the rules given in table 4-1 below. When two NEXT fields are specified, they operate as a logical "exclusive-OR."

Note: selected examples of the commands and their operands are given at the end of this Section; moreover, Appendix E lists all of the default polling programs and explains their commands.

Table 4-1. PPB Commands, Operands, and NEXT Statements

| CMD | Operand | NEXT |
|---|---|---|
| XMIT | (Transmit) Up to 16 characters, entered in hex. The 801B automatically transmits all necessary link control characters including opening and closing flags in bit-oriented protocols, and sync and <BCC> characters (depending on the setup page entries). | One or two NEXT fields are permitted. A single NEXT field (the left) can direct line containing any of the six commands. |
| | Special XMIT Characters. In EBCDIC and ASCII codes, pressing [FUNCTN] "F" causes the operand field to display a dim video "F," signifying the "fox message." In ASCII, pressing FUNCTN "C" (dim video "C") causes the 801B to transmit the ASCII set of printable characters (:20 - :7E). | Two NEXT fields can point to RECV and TOUT statements, or RECV and RECV. The program branches to the first logically true statement. |

Table 4-1. PPB Commands, Operands, and NEXT Statements (Cont.)

| CMD | Operand | NEXT |
|---|---|---|
| RECV | (Receive) When the incoming data off the link matches the characters in the RECV operand, the program advances to the next statement. The RECV string may be up to 8 characters for ASYNC, SYNC, or IPARS. For HDLC and SDLC protocols, the RECV string must be 16 bits (binary ones and zeros) in length.<br><br>The "DON'T CARE" character can be entered at any character or bit position in the string, and is displayed as a dim video "X." The RECV string may also "look for" a "<bad BCC>." Press FUNCTN B; "<bad>" appears in normal video to the right of the operand field. In this case, the <bad BCC> is the only entry allowed in the RECV string. The "DON'T CARE" character (shown as "X" in dim video) and the <bad BCC>, are the only special characters allowed in RECV operands. | One NEXT field is permitted. |
| TOUT | (Time Out) The program advances to the NEXT statement at the expiration of the TOUT value. The operand consists of two fields: a 4-digit numeric (data entry) field and a (selectable) units field. Note: when TOUT is executed with a RECV command, the TOUT value is in seconds, regardless of the units selection (e.g., an XMIT command's NEXT fields point to RECV and TOUT lines). | One NEXT field |
| CNT | (Count) A four-digit decimal field, from 0 to 9999. Both NEXT fields must be defined. | The program branches to the first (left) NEXT field if the count is incomplete; to the second (right) NEXT field at completion of the count. |

Table 4-1. PPB Commands, Operands, and NEXT Statements (Cont.)

| CMD | Operand | NEXT |
|---|---|---|
| END | Halts program operation: no operand. The 801B enters the Capture mode. | No NEXT field |
| NOP | (No operation). The operand field is blank. This statement is useful in editing programs. Using NOP, you can "erase" a single line in the middle of a program without having to re-enter all of the following lines. | The NEXT fields are optional. If the NEXT fields are blank, the program executes the next line; from a NOP in line #9, the program executes line #0. |
| | | These operate as with the XMIT command. |

## 4.8 EXAMPLES OF POLLING PROGRAMS

The following program tests a printer. The transmission code is 7-bit ASCII, asynchronous.

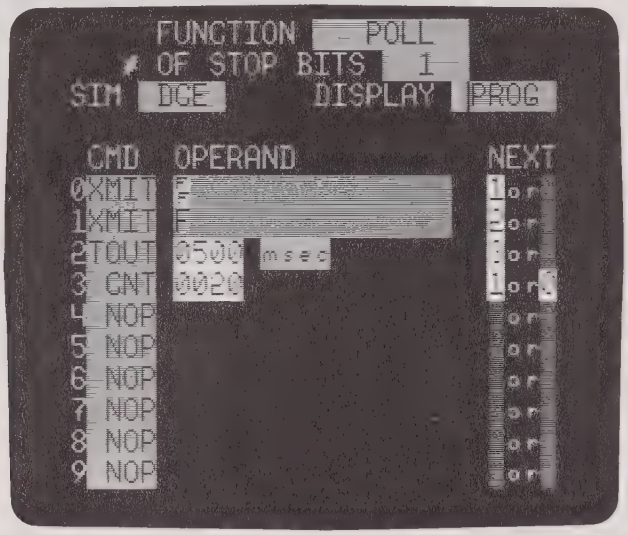



Figure 4-6. Printer Test Program

1. Statement #0 transmits a form feed, clearing the printer and bringing up a blank page. The program advances to statement #1.

2. Statement #1 sends the "fox message." Carriage return and linefeed characters are embedded in the fox message. The program advances to statement #2.

3. Statement #2 provides a half-second delay; #3 is NEXT.

4. Statement #3 causes 20 "fox messages" to be printed on the page (statement #1), then issues a formfeed and repeats the program (statement #0).

The program prints a page of "fox messages," ejects the paper and repeats. To make the program stop, enter an END statement at line #4, and edit statement #3's second NEXT field to read "4." To print 5 pages and stop, put a second CNT statement at line #4, enter "5" in the operand field, and point the NEXT fields to #0 and #6. Add an END statement at line #6.

---

The following program (next page) causes the 801B to repeatedly poll a terminal using SYNC 3270 protocol. The program is selection #2 on the MENU page for SYNC protocol; the transmission code is EBCDIC.

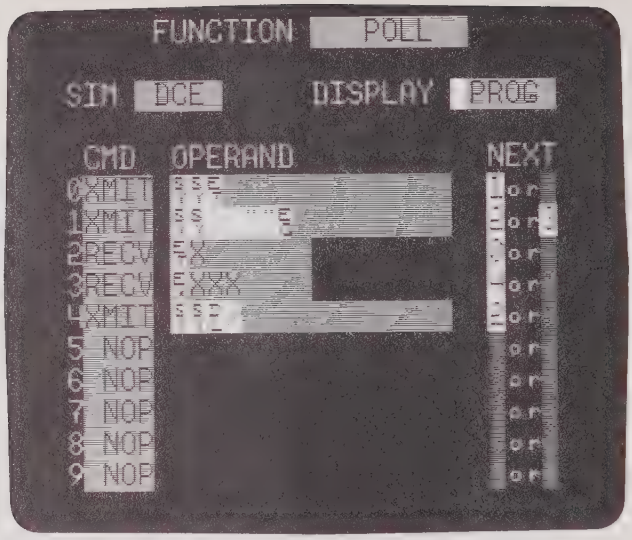



Figure 4-7. SYNC 3270: Terminal Polling Program

Note: extra sync characters are included in the XMIT operands in order to ensure that the remote device will synchronize with the transmission. Thus, in this example, the 801B sends four (4) syncs.

1. Line #0 causes the 801B to transmit the line clearing message: <SYN>, <SYN>, <EOT>, and <PAD>. The <SYN> and <PAD> (resync) characters are specified on the the setup page, and vary between protocols. The NEXT field directs the program to line #1, another XMIT command.

2. Line #1 transmits a general poll. It consists of a two-byte Station Select Address (:4040, default), a two-byte Device Address (:7F7F, default), and the <ENQ> character (:2D). Press [CODE/HEX] to view these characters in hexadecimal. The message is preceded and followed by sync and resync characters. Line #1's NEXT fields have two entries, 2 or 3. After the general enquiry is transmitted, the program looks for either Line #2 or #3.

3. Line #2: The 801B receives an <EOT>, indicating that the polled device has nothing to transmit. The dim video "X" ("don't care") character keeps the 801B monitoring for at least one more character, in order to store the <pad> (resync) character in the capture buffer. Since the terminal has nothing to transmit, the program returns to line #, repeating the line clear and enquiry.

4. Line #3. In this case, the polled device transmits some data. The transmission consists of <SYN>, <SYN>, <STX>, <DATA ... DATA>, <ETX>, <BCC>, <BCC>, and <PAD>. Notice that line #3 looks for the final <ETX>, <BCC>, <BCC>, and <PAD> only. If line #3 is received, the program advances to line #4.

5. Line #4. The 801B transmits an <ACK1>, and returns to line #2 to see if the device acknowledges.

# SECTION 5 - X.25 PROTOCOL ANALYSIS

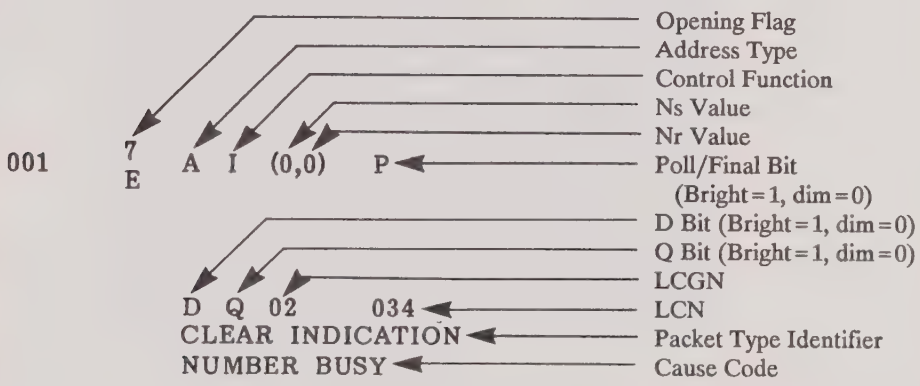
## 5.1 RATIONALE

The following discussion is written under the assumption that the user is familiar with the terms and nomenclature of HDLC protocol. An extensive discussion of the X.25 protocol is given in Appendix D.

## 5.2 GENERAL

The Model 801B Data Link Monitor is equipped with the X.25 protocol analysis. In general, the data may still be monitored and displayed as discussed in sections 3, 4, and 5, above. But it is difficult to find errors in the raw data of frame- and packet-level communications since individual bits within each byte have meanings.

The X.25 protocol analysis presents these data in a coded format, in which the control field, logical channel number, packet type identifier, etc., are displayed as easy-to-understand mnemonics (see Figure 5-1).




Note: when the P, D, and Q bits are displayed in bright video, they are equal to "1;" in dim video, "0."

Figure 5-1. Typical X.25 Display Format

## 5.3 OPERATING INSTRUCTIONS

### Line Monitoring

Monitor the data link normally, as described in Section 3. Configure the 801B to match the X.25 interface by means of the setup page selections, or use the Automonitor@ function. Note: the PROTOCOL field must be set to HDLC.

### Analysis

After the unit is placed in the capture mode (by pressing [CAPTURE] or by detection of the stop trigger), press the [ANALYZE] key to initiate the X.25 analysis. The 801B then displays the capture buffer in the X.25 analysis format, starting with the first frame in the capture buffer (See Figure 5-2).

Capture buffer frame number

Frame-level analysis in normal video

Packet-Level analysis in reverse video

Data packet info.

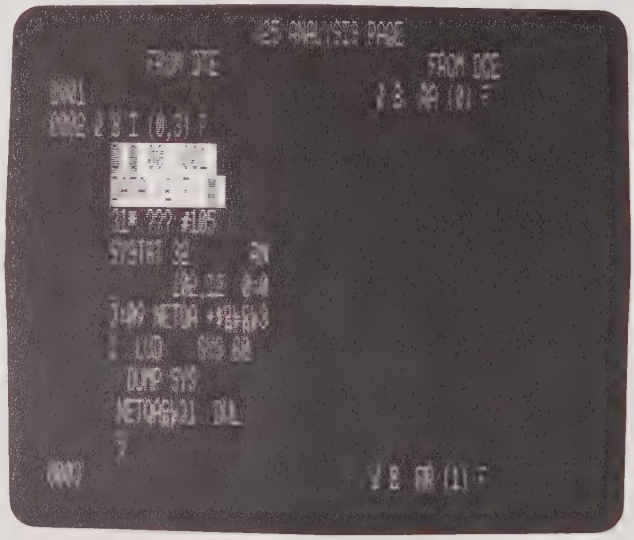


Figure 5-2. X.25 Analysis Page

The three-digit number at the left of the screen identifies the frame's position in the capture buffer. The description (mnemonic) appears in the column under FROM DTE or FROM DCE, depending on the source of the frame. Frame level (level 2) mnemonics are displayed in normal video; packet level (level 3) in reverse video. The display format for each frame type is shown in Table 5-1.

To view the data in hexadecimal, press [CODE/HEX]. The current frame is then displayed in hexadecimal immediately under the mnemonic.

To view the data in a data packet, press [SHIFT], [ANALYZE]. The data packet is displayed in normal video immediately under the mnemonic. Press [SHIFT], [ANALYZE] again to return to normal presentation for all subsequent frames.

To scroll through the data frame by frame, press [SCROLL-up or -down]. Movement continues as long as the key is depressed. Press [SHIFT], [SCROLL (-up or -down)] to initiate automatic scrolling; press [SCROLL (-

up or -down)] to terminate the movement. (Jump scrolling is not implemented for X.25 analysis.) Press [HOME] to return to frame #1.

To return to the normal capture buffer display, simply press [PAGE].

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| Supervisory Frames | | |
| Receive Ready (RR) | 7 B RR (0) P | 7007<br>EE11E |
| Receive Not Ready (RNR) | 7 B RNR (0) P | 7007<br>EE15E |
| Reject (REJ) | 7 B REJ (0) P | 7007<br>EE19E |
| Unnumbered Frames | | |
| Set Asynchronous Response Mode (SARM) | 7 B SARM P<br>E | 7007<br>E1FE |
| Set Asynchronous Balanced Mode (SABM) | 7 B SABM P<br>E | 7027<br>E1FE |
| Disconnect (DISC) | 7 B DISC P<br>E | 7047<br>E13E |
| Unnumbered Acknowledge (UA) | 7 A UA F<br>E | 7067<br>E33E |
| Disconnected Mode (DM) | 7 A DM F<br>E | 7007<br>E3FE |
| Command or Frame Reject | 7 A CMDR F<br>E | 7087<br>E37E |
| Information Frames | | |
| Call Request | 7 B I (0,0) P<br>E D Q 00 000<br>CALL REQUEST | 700100<fcs>7<br>E10008E |
| Incoming Call | 7 A I (0,0) P<br>E D Q 00 000<br>INCOMING CALL | 700100<fcs>7<br>E3000BE |

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| Call Accepted | 7 A I (0,0) F<br>E D Q 00 000<br>CALL ACCEPTED | 700100<fcs>7<br>E3000F E |
| Call Connected | 7 B I (0,0) F<br>E D Q 00 000<br>CALL CONNECTED | 700100<fcs>7<br>E1000F E |
| Clear Request<br>(DTE Clearing) | 7 B I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>DTE CLEARING | 7001010<fcs>7<br>E100030 E |
| Clear Indication<br>(Number Busy) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>NUMBER BUSY | 7001010<fcs>7<br>E300031 E |
| Clear Indication<br>(Invalid Facility<br>Request) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>INVALID CALL | 7001010<fcs>7<br>E300033 E |
| Clear Indication<br>(Network Congestion) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>NETWORK CONGESTION | 7001010<fcs>7<br>E300035 E |
| Clear Indication<br>(Out of Order) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>OUT OF ORDER | 7001010<fcs>7<br>E300039 E |
| Clear Indication<br>(Access Barred) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>ACCESS BARRED | 7001010<fcs>7<br>E30033B E |

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| Clear Indication (Not Obtainable) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICTION<br>NOT OBTAINABLE | 7001010 <fcs> 7<br>E30003D E |
| Clear Indication (Remote Procedure Error) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>REMOTE PROCEDURE ERROR | 7001011 <fcs> 7<br>E300031 E |
| Clear Indication (Local Procedure Error) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>LOCAL PROCEDURE ERROR | 7001011 <fcs> 7<br>E300033 E |
| Clear Indication (RPOA Out of Order) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>RPOA OUT OF ORDER | 7001011 <fcs> 7<br>E300035 E |
| Clear Indication (Reverse Charging Acceptance Not Subscribed) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION<br>NUMBER REFUSING COLLECT CONNECTION | 7001011 <fcs> 7<br>E300039 E |
| Clear Indication (Incompatible Destination) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION2 | 7001012 <fcs> 7<br>E300031 E |
| Clear Indication (Fast Select Acceptance) | 7 A I (0,0) P<br>E D Q 00 000<br>CLEAR INDICATION2 | 7001012 <fcs> 7<br>E300039 E |
| DTE Clear Confirmation | 7 A I (0,0) F<br>E D Q 00 00<br>CLEAR CONFIRMATION | 700101 <fcs> 7<br>0E3000 E |

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| DCE Clear Confirmation | 7 B I (0,0) F<br>E D Q 00 000<br>CLEAR CONFIRMATION | 700101 <fcs> 7<br>E10007 E |
| DTE Data | 7 B I (0,0) P<br>E D Q 00 000<br>DATA (0,0) M | 700100... <fcs> 7<br>E10000 E |
| DCE Data | 7 A 1 (0,0) P<br>E D Q 00 000<br>DATA (0,0) M | 700100... <fcs> 7<br>E30000 E |
| DTE Interrupt | 7 B I (0,0) P<br>E D Q 00 000<br>INTERRUPT | 700102 <fcs> 7<br>E10003 E |
| DCE Interrupt | 7 A I (0,0) P<br>E D Q 00 000<br>INTERRUPT | 700102 <fcs> 7<br>E30003 E |
| DTE Interrupt Confirmation | 7 A I (0,0) F<br>E D Q 00 000<br>INTERRUPT CONFIRMATION | 700102 <fcs> 7<br>E30007 E |
| DCE Interrupt Confirmation | 7 B I (0,0)F<br>E D Q 00 000<br>INTERRUPT CONFIRMATION | 700102 <fcs> 7<br>E10007 E |
| DTE Receive Ready (RR) | 7 B I (0,0) P<br>E D Q 00 000<br>RR (0) | 700100 <fcs> 7<br>E10001 E |
| DCE Recieve Ready (RR) | 7 A I (0,0) P<br>E D Q 00 000<br>RR (0) | 700100 <fcs> 7<br>E30001 E |
| DTE Receive Not Ready (RNR) | 7 B I (0,0) P<br>E D Q 00 000<br>RNR (0) | 700100 <fcs> 7<br>E10005 E |

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| DCE Receive Not Ready (RNR) | 7 I (0,0) P<br>E D Q 00 000<br>RNR (0) | 700100 <fcs> 7<br>E30005 E |
| DTE Reject (REJ) | 7 B I (0,0) P<br>E D Q 00 000<br>REJ (0) | 700100 <fcs> 7<br>E10009 E |
| DCE Reject (REJ) | 7 B I (0,0) P<br>E D Q 00 000<br>REJ (0) | 700100 <fcs> 7<br>E30009 E |
| DCE Reject (REJ) | 7 B I (0,0) P<br>E D Q 00 000<br>REJ (0) | 700100 <fcs> 7<br>E30009 E |
| Reset Request (DTE Reset) | 7 B I (0,0) P<br>E D Q 00 000<br>RESET REQUEST<br>DTE RESET | 700100 <fcs> 7<br>E100B0 E |
| Reset Indication (Out of Order) | 7 A I (0,0) P<br>E D Q 00 000<br>RESET INDICATION<br>DTE OUT OF ORDER | 7001010 <fcs> 7<br>E3000B1 E |
| Reset Indication (Remote Procedure Error) | 7 A I (0,0) P<br>E D Q 00 000<br>RESET INDICATION<br>REMOTE PROCEDURE ERROR | 7011010 <fcs> 7<br>E3000B3 E |
| Reset Indication (Local Procedure Error) | 7 A I (0,0) P<br>E D Q 00 000<br>RESET INDICATION<br>LOCAL PROCEDURE ERROR | 7001010 <fcs> 7<br>E3000B5 E |

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| Reset Indication (Network Congestion) | 7 A I (0,0) P<br>E D Q 00 000<br>RESET INDICATION | 7001010 <fcs> 7<br>E3000B7 E |
| Reset Indication (Network Operational) | 7 A I (0,0) P<br>E D Q 00 000<br>RESET INDICATION | 7001010 <fcs> 7<br>E3000BF E |
| Reset Indication (Incompatible Destination) | 7 A I (0,0) P<br>E D Q 00 000<br>RESET INDICATION | 7001011 <fcs> 7<br>E3000B1 E |
| DTE Reset Confirmation | 7 A I (0,0) F<br>E D Q 00 000<br>RESET CONFIRMATION | 700101 <fcs> 7<br>E1000F E |
| DCE Reset Confirmation | 7 B I (0,0) F<br>E D Q 00 000<br>RESET CONFIRMATION | 700101 <fcs> 7<br>E3000F E |
| Restart Request (DTE Restart) | 7 B I (0,0) P<br>E D Q 00 000<br>RESTART REQUEST | 70010F0 <fcs> 7<br>E1000B0 E |
| Restart Indication (Local Procedure Error) | 7 A I (0,0) P<br>E D Q 00 000<br>RESTART INDICATION<br>LOCAL PROCEDURE ERROR | 70010F0 <fcs> 7<br>E3000B1 E |
| Restart Indication (Network Operational) | 7 A I (0,0) P<br>E D Q 00 000<br>RESTART INDICATION<br>NETWORK OPERATIONAL | 70010F0 <fcs> 7<br>E3000B2 E |

Table 5-1. X.25 Analysis Display Format

| | DISPLAY | HEXADECIMAL |
|---|---|---|
| Restart Indication<br>(Network Congestion) | 7 A I (0,0) P<br>E D Q 00 000<br>RESTART INDICATION<br>NETWORK CONGESTION | 70010F0 <fcs> 7<br>E3000B3 E |
| DTE Restart Confirmation | 7 A I (0,0) F<br>E D Q 00 000<br>RESTART CONFIRMATION | 70010F <fcs> 7<br>E3000F E |
| DCE Restart Confirmation | 7 B I (0,0) F<br>E D Q 00 000<br>RESTART CONFIRMATION | 70010F <fcs> 7<br>E1000F E |

# SECTION 6 -- DDCMP ANALYSIS

## 6.1 GENERAL

DDCMP is the designation recommended by Digital Equipment Corporation for use over DECNET. The treatment of this protocol herein should not be considered exhaustive, but merely as an overview. The user is referred to Digital Data Communications Message Protocol (DDCMP), Specification, Version 4.0, March 1, 1978, by Digital Equipment Corporation, Maynard, Massachusetts, USA, 01754.

Using the DDCMP analysis package, data off a communications link may still be monitored, captured, and displayed as described in Section 3 above. The header, control, and data fields of DDCMP frames can then be displayed as easy-to-understand mnemonics.

## 6.2 OPERATING INSTRUCTIONS

### Line Monitoring

To set up the 801B to monitor DDCMP protocol, press [PAGE 1], bringing up the setup (configuration) page. Place the cursor in the PROTOCOL field, and press [ENTER] until DDCMP-A (asynchronous) or DDCMP-S (synchronous) appears. The rest of the setup page changes to match the protocol selection.

The instrument defaults to suppression of all-but-two SYNC characters. The default transmission code is 8-bit ASCII.

Place the unit in the RUN mode, and allow data to accumulate in the capture buffer.

Analysis

After the 801B is placed in the capture mode (by pressing [CAPTURE], or by the detection of a stop trigger), press the [ANALYZE] key to initiate the DDCMP analysis. The 801B then displays the contents of its capture buffer in the protocol analysis format, starting with the first message in the capture buffer (see figure 6-1).

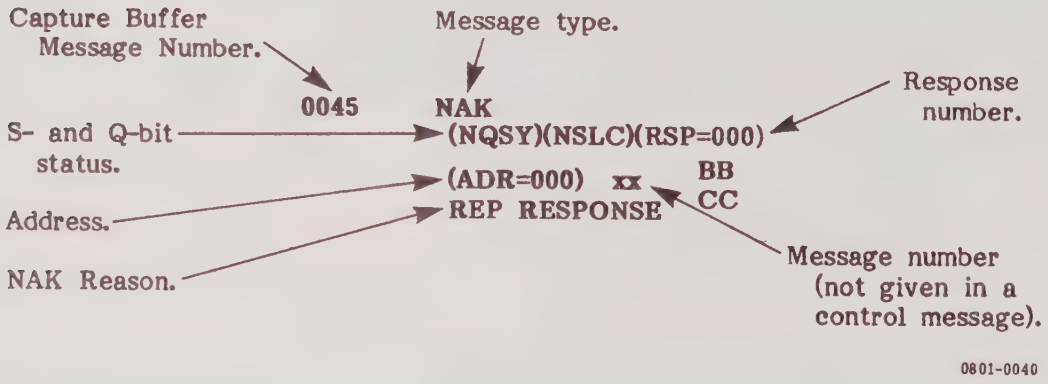



Figure 6-1. Typical DDCMP Analysis Display

The three-digit number at the left of the screen gives the message number, i.e., its position in the capture buffer. The message type (mnemonic) appears in the column under FROM DTE or FROM DCE, depending on the source of the message.

BCC characters are displayed in bright intensity.

The display format for each type of message is given in table 6-1.

To display the message in hexadecimal, press [CODE/HEX]. The hexadecimal equivalent of the message is presented under the mnemonic for the last frame displayed.

To conserve space on the CRT display, the instrument defaults to suppression of data in maintenance and data messages. The keystroke combination [SHIFT], [ANALYZE] acts as a toggle to enable and disable the display of the data portion in the message. Press [SHIFT], [ANALYZE] to display the data; press the combination again to suppress the data.

To scroll through the data, press [SCROLL (-up or -down)]. Pressing [SCROLL-down] causes the preceding message to be displayed, even though it appears to move "upward" on the display. The display advances or backs up one message at a time through the contents of the capture buffer. Automatic scrolling is enabled.

To return to the first message in the buffer, press [HOME].

To return to the normal capture buffer display, press [PAGE 0].

To enter the run mode (i.e., to collect more data), press [RUN] from the DDCMP analysis page.

To output the current display to a printer, press [PRINT].

## DDCMP Analysis - Background

A detailed discussion of DDCMP is beyond the scope of these Operating Instructions. Those seeking further information should obtain the following document from Digital Equipment Corporation:

DECNET
Digital Network Architecture
Digital Data Communication Message Protocol - DDCMP
Specification
Version 4.0
1-March-1978

Table 6-1. DDCMP Mnemonics

| Mnemonic | BCC | Comment |
|---|---|---|
| Control Messages: | | |
| START<br>(NQSY)(NSLC)(ADR=000) | BB<br>CC | (NQSY) means "no Q-Sync flag."<br>(NSLC) means "no Select flag."<br>(ADR) means "address." |
| STACK<br>(NQSY)(NSLC)(ADR=000) | BB<br>CC | (QSYN) means "Q-sync flag set."<br>(SLCT) means "Select flag set." |
| REP<br>(NQSY)(NSLC)(RSP=000)<br>(ADR=000) | BB<br>CC | The BCC byte is appended to the address portion of the mnemonic. |
| ACK<br>(NQSY)(NSLC)(RSP=000)<br>(ADR=000) | BB<br>CC | |
| NAK<br>(NQSY)(NSLC)(RSP=000)<br>(ADR=000)<br><NAK reason> | BB<br>CC | The <NAK reason> is given on the line following the NAK analysis display. |
| NAK reasons: | | |
| HEADER FIELD BLOCK CHECK ERROR | | |
| DATA FIELD BLOCK CHECK ERROR | | |
| REP RESPONSE | | |
| BUFFER TEMPORARILY UNAVAILABLE | | |
| RECEIVER OVERRUN | | |
| MESSAGE TOO LONG | | |
| MESSAGE HEADER FORMAT ERROR | | |

Table 6-1. DDCMP Mnemonics (cont.)

| Mnemonic | BCC | Comment |
|---|---|---|
| Data Messages: | | |
| DATA<br>(CNT=00000)(QSYN)(SLCT)<br>(RSP=000)(NUM=000)<br>(ADR=000) | BB<br>CC | Count (CNT) field indicates the number of data bytes (up to 16,383($2^{14}$-1). |
| <Data> | BB | |
| <Data> | CC | |
| Maintenance Messages: | | |
| MAINT<br>(CNT=00000)<br>(QSYN)(SLCT)(ADR=000) | BB<br>CC | |
| <Data> | BB | |
| <Data> | CC | |

# SECTION 7 -- SNA PROTOCOL ANALYSIS

## 7.1 GENERAL

The SNA protocol analysis feature analyzes not only the protocol of the physical channel, but also the protocol of the logical data flow between the end users.

In general, data from a communications link may still be monitored, captured, and displayed as described in Section 3, above. Since individual bits within each octet of an SNA header frame often have meaning, the SNA protocol analysis option presents these bit fields as easy-to-understand mnemonics.

## 7.2 OPERATING INSTRUCTIONS

### Line Monitoring

To set up the 801B to monitor an SNA link, press [PAGE 1] calling up the setup (configuration) page. Place the cursor in the PROTOCOL field, and repeatedly press [ENTER] until SDLC is displayed. The remaining fields on the setup page change to match the protocol selection; make any other changes as necessary.

Place the unit in the RUN mode, and allow data to accumulate in the capture buffer.

### Analysis

After the 801B is placed in the capture mode (by pressing [CAPTURE], or by the detection of a stop trigger), press the [ANALYZE] key to initiate SNA analysis. The 801B then displays the contents of its capture buffer in the SNA analysis format, starting with the first frame in the capture buffer (see figure 7-1).

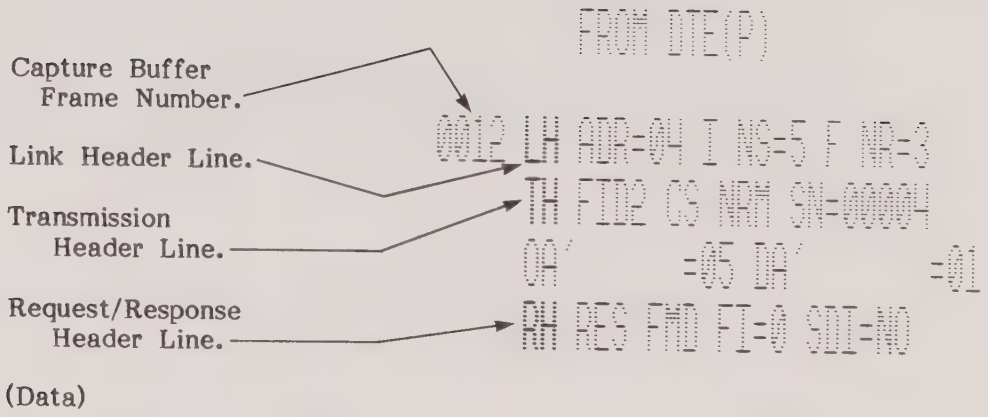



Figure 7-1. Typical SNA Analysis Display

The four-digit number at the left of the screen is the frame number (as it appears in the capture buffer). The mnemonics for the frame appear in the column under FROM DCE (primary station) or FROM DTE (secondary station), depending on the source of the frame. (Should you find that the secondary station is displayed in the FROM DCE column, press [ENTER] to toggle to the column headings.)

Generally, the header data are displayed in the order shown in figure 7-1. Header mnemonics (LH, TH, RH) and error messages (INCOMPLETE BIU, INVALID LENGTH, PATH ERROR, etc.) are displayed in bright intensity.

Section 7.3 (below) gives the format for each frame type; table 7-1 lists the mnemonics in alphabetical order.

To display the message in hexadecimal, press [CODE/HEX]. The hexadecimal equivalent of the message is presented under the mnemonic.

To scroll through the data, press [SCROLL (-up or -down)]. The display advances or backs up one frame at a time through the contents of the capture buffer. Pressing [SHIFT], [SCROLL (-up or -down)] causes the display to advance or back up automatically, which enables you to scan through the data to find the frame of interest. Press either [SCROLL] key to stop the automatic scrolling. Press [HOME] to return the display to the first frame in the capture buffer.

If the data in the Request/Response portion of an SNA frame is longer than about 450 bytes, the header may scroll off the top of the screen. To suppress the display of all but the first line of data (one line is displayed so that you can identify the message), press [SHIFT], followed by [ANALYZE]. In this case, the data is scrolled upward or downward one display line at a time. Pressing the [SHIFT], [ANALYZE] combination a second time returns the normal SNA display.

Pressing [PRINT] outputs the current display to a printer.

To return to the normal capture buffer display, press [CAPTURE]; to return to the setup (configuration) page, press [PAGE 1].

## 7.3 DISPLAY FORMAT

I Frame (Information Frame)

A. I Frame with FID1

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID1 <SEG> <EFI> SN=00000
        OA=00 DA=00 DC=00000
        RH <RRI> <RU> FI=0 SDI=<YES/NO>
        <DATA>
```

B. I Frame with FID1, and blocking PIU (multiple TH)

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID1 <SEG> <EFI> SN=00000
        OA=00 DA=00 DC=00000
        RH <RRI> <RU> FI=0 SDI=<YES/NO>
        <DATA>

        TH FID1 <SEG> <EFI> SN=00000
        OA=00 DA=00 DC=00000
        RH <RRI> <RU> FI=0 SDI=<YES/NO>
        <DATA>
```

C. I Frame with FID2, and RH, RU

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID2 <SEG> <EFI> SN=00000
        OA=00 DA=00
        RH <RRI> <RU> FI=0 SDI=<YES/NO>
        <DATA>
```

D. I Frame with FID2 with RU only (without RH)

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID2 <SEG> <EFI> SN=00000
        OA=00 DA=00
        <DATA>
```

E. I Frame with FID3 with RH, RU

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID3 <SEG> <EFI> <LU/SSCP> <LU/PU>
        RH <RRI> <RU> FI=0 SDI=<YES/NO>
        <DATA>
```

F. I Frame with FID3 with RU only (without RH)

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID3 <SEG> <EFI> <LU/SSCP> <LU/PU>
        DATA>
```

G. I Frame with error message(s) in header (e.g., path error in RH).

```
<#>     LH ADR=00 I NS=0 <P/F> NR=
        TH FID1 <SEG> <EFI> SN=00000
        OA=00 DA=00 DC=00000
        RH <RRI> <RU> FI=0 SDI=<YES/NO>
        PATH ERROR
```

H. I Frame with FID type equal to or greater than 4.

```
<#>     LH ADR=00 I NS=0 <P/F> NR=0
        TH FID=00
```

S Frame (Supervisory Frame)

```
<#>     LH ADR=00 <S> <P/F> NR=0
```

U Frame (Unsequenced Frame)

```
<#>     LH ADR=00 <U> <P/F>
```

Table 7-1. Alphabetical List of Mnemonics and Abbreviations

| Mnemonic | Meaning |
|---|---|
| <#> | Capture buffer frame number. |
| ADR | SDLC link address for secondary station (1 byte, hex). |
| BIU | Basic Information Unit. |
| BLU | Basic Link Unit. |
| BTU | Basic Transmission Unit. |
| DA | Destination address field (2 bytes, hex). |
| DC | Data count field (2 bytes, 5-digit decimal, used as blocking PIU). |
| <EFI> | Expedited flow indicator.<br><br>EXP -- Expedited flow.<br>NRM -- Normal flow. |
| FI | Format indicator.<br><br>FI=0 -- no FM header.<br>FI=1 -- FM header following. |
| FID | Format Identification |
| I | Information Frame. |
| LH | Link Header; displayed for all frame types. |
| <LU/SSCP> | Logical Unit/System Service Control Point indicator; shows the logical connection between end users.<br><br>LU-LU - Logical connection between two LUs.<br>SS-LU - Logical connection between SSCP and LU. |
| <LU/PU> | LU/PU indicator.<br><br>LU - Logical Unit<br>PU - Physical Unit |
| NR | Receive sequence count (from 0 to 7). |
| NS | Send sequence count (from 0 to 7). |
| OA | Origin address field (2 bytes, hex). |

Table 7-1. Alphabetical List of Mnemonics and Abbreviations(cont.)

| Mnemonic | Meaning |
|---|---|
| <P/F> | Poll or Final bit. The primary station always sets or resets the poll bit; the secondary station, the final bit.<br><br>F - Final bit set.<br>P - Poll bit set. |
| PIU | Path Information Unit. |
| RH | Request/response header. |
| <RRI> | Request-response indicator.<br><br>REQ request.<br>RES response. |
| <RU> | Request-response unit category.<br><br>DFC Data flow control.<br>FMD FM Data.<br>NC Network control.<br>SC Session control. |
| <S> | Supervisory frame; types given below:<br><br>REJ Reject.<br>RNR Receiver Not Ready.<br>RR Receiver Ready. |
| SDI | Sense data included indicator.<br><br>SDI=NO for sense data not included.<br>SDI=YES for sense data included. |
| <SEG> | Segmentation mapping field.<br><br>CS Complete Segment (i.e., the entire BIU).<br>FS First segment.<br>LS Last segment.<br>MS Middle segment. |
| SN | Sequence number field. (2 bytes, 5-digit decimal). |
| TH | Transmission header. Follows LH for I Frames only. |

Table 7-1. Alphabetical List of Mnemonics and Abbreviations(cont.)

| Mnemonic | Meaning | |
|---|---|---|
| <U> | Unsequenced frame; types given below: | |
| | BCN | Beacon frame |
| | CFGR | Configuration frame |
| | DISC | Disconnect |
| | DM | Disconnected Mode |
| | FRMR | Frame Reject. |
| | RD | Request Disconnect |
| | RIM | Request Initialization Mode |
| | SIM | Set Initialization Mode |
| | SNRM | Set Normal Response Mode |
| | TEST | Test |
| | UA | Unnumbered Acknowledge |
| | UI | Unnumbered Information |
| | UP | Unnumbered Poll |
| | XID | Exchange Station Identification. |

Table 7-2. Error Messages

| ERROR MESSAGE/Comment |
|---|
| CRC ERROR. Identified by a hex character in flashing bright intensity. On the SNA analysis page, the characters appear at the end of each error frame. Note that flashing CRC bytes may be observed in the real-time display (run mode), in the capture buffer display, and in the SNA Analysis display. |
| RECEIVER OVERRUN. The data have arrived faster than the instrument can analyze them. To correct, use the FAST selection in the MONITOR field. |
| NOT MOD8 ERROR. The received character is not 8 bits long. This usually occurs at the last character of each frame. |
| INCOMPLETE BIU. BIU size is less than the value in DCF. |
| INVALID LENGTH. Error in SDLC link address field. |
| PATH ERROR. Error in RH. |
| INVALID C BYTE. Invalid S or U frame. |
| INCOMPLETE PIU. Error in TH. |

# APPENDIX A -- SPECIFICATIONS

## A.1 SPECIFICATIONS

| | |
|---|---|
| **Mechanical** | |
| Height | 5.5 in. (14 cm). |
| Width | 14.75 in. (37.5 cm). |
| Depth | 17.00 in. (45.1 cm). |
| Weight | 12 lbs (5.44 kg). |
| **Environmental** | |
| Temperature | 32 to 120 deg. F (0 to 50 deg. C). |
| Relative Humidity | 0 to 95%, noncondensing. |
| **Electrical** | |
| Input Voltage | 115 or 230 V ac. |
| Frequency | 50-60 Hz. |
| Power Consumption | 150 VA. |
| Sustaining Battery | 3V Lithium "coin-type" |
| **Interface** | |
| Types | RS-232-C (V.24) and current loop. |
| Protocols | Asynchronous, synchronous byte-controlled (BSC, IPARS, or similar protocols)<br>Synchronous bit-oriented (SDLC, HDLC, or similar protocols)<br>Isochronous (async data with external clock). |
| Codes | ASCII, EBCDIC, Baudot, IPARS, Selectric, EBCD, and SBT. |
| Data Rates | |
| Monitoring | 50 bps to 56 kbps full duplex. |
| Polling | 50 to 9600 bps. |
| Internal speeds | 50, 75, 100, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, and 19,200 bps; |
| External clock | X1 and X16 bps. |
| **Display** | |
| Type | CRT, 5-in diagonal. |
| Size | 512 or 1024 characters (16x32 or 16x64). |
| Display Modes | Line multiplex (with and without pad); Time multiplex DTE only and DCE only. |
| Video Attributes | Bright, normal, and dim intensities; Normal (white on black background) and reverse (black on white) characters; Blinking, underline, and cursor. |

| | |
|---|---|
| **EIA Line Monitor** | |
| Display | 12 tri-state LEDs monitor line status; Red-Mark, Green-Space, Off-Inactive. |
| Test Points | 21 connections to monitor EIA circuits;<br>1 clock imput;<br>1 signal ground;<br>2 +12V dc (spacing) output;<br>2 -12V dc (marking) output;<br>1 programmed EIA output;<br>2 external inputs (transition detectors). |
| **Memory** | |
| CPU Memory | 4k byte CMOS RAM* |
| Firmware Memory | 64k byte PROM. |
| Video Buffer | 2k byte RAM. |
| Capture Buffer | 16k bytes CMOS RAM* (8 K data, 8 K status) |
| Other Memory | 4k bytes CMOS RAM*.<br>*24k bytes CMOS RAM receive power from sustaining battery in the absence of ac power. |
| **Software** | |
| Event Counters | 30, up to 65,535 (64k) counts each. |
| Event Timer | 2, up to 64k seconds each. |
| Trapping | EIA lead status and/or up to 3 patterns on each side (up to 24 characters per pattern) |
| Block Checking | BCC polynomials, Characters CRC-16, CRC-6, CCITT-16, VRC/LRC. |
| Bit Error Rate Test | Transmit, receive, and loopback; sync and async protocols. |
| Printer output | All codes (listed under "Interface," above); all internal rates; no parity, 2 stop bits |
| Interactive Polling | All protocols except DDCMP. |
| **Video Interface** | |
| Sync Output | Composite, 1 V p-p into 75 ohm load, negative. |
| Horizontal Frequency | 15.75 kHz. |
| Vertical Frequency | 50 or 60 Hz, selectable. |
| Horizontal Pulse Width | 5.2 us. |
| Vertical Pulse Width | 1.0 ms. |
| Horizontal Scan to Retrace Ratio | 64/32. |
| Vertical Scan to Retrace Ratio | 17/5. |
| Color Outputs | Red, Green, And Blue; 1V p-p into 75 ohm load. |

## A.2 OPTIONS AND ACCESSORIES

The following options and accessories are available for the Model 801B. Part numbers are given in parentheses

- Rack Mounting Kits. Two rack mounting kits are available that permit mounting the monitor in 19- and 23-inch racks.

  (a) 19-inch Rack Adapter: (8220-0034-54).

  (b) 23-inch Rack Adapter: (8220-0034-55).

- Padded Lightweight Field Case. A molded plastic, padded, light weight field case (1403-0003-67) provides limited protection for the monitor during transit.

- Heavy Duty Shipping Truck. A fiberglass, heavy-duty, shipping trunk (1403-0001-00) provides protection for the monitor during shipping.

- Rs-232 Cable Assembly; 6 feet long, Bisex to Bisex (6010-0004-46)

- Extra Operating Practices: (4200-0801-03)

# APPENDIX B - ERROR CODES

## B.1 PRINTER/POLL and BERT ERRORS

The following errors are included with the Printer/Poll and BERT) functions. When you press the SEND key, the 801B scans the setup pages and the user-defined program for errors. If an error is found, the CRT displays the error number; if the error occurs in the user-defined program, both the error number and the program line number are also displayed. Errors 01 through 08 report error conditions on the setup page. Errors 10 and higher report errors on the PRINTER/POLL or BERT program pages.

ERR01: ILLEGAL CODE / PARITY / CRCC

The setup page selections for CRCC fails to match the transmission CODE selection. For example, ASCII-8 must use CRC-16 checking, but ASCII-7 uses VRC/LRC.

ERRO2: CURRENT LOOP NOT ALLOWED

PPB operations are not currently implemented for current loop interfaces.

ERR03: INVALID KEY PRESSED

In many cases, pressing an invalid key causes the 801B to emit a tone. This error message occurs, for example, when [SEND] is pressed from the setup page instead of the PPB page.

ERR04: SUPPRESS TEXT NOT ALLOWED

If you were able set up the 801B to suppress text, you might miss the RECV string; therefore, the polling program's RECV operand takes precedence. Do not attempt to suppress text (PAGE 1 selection) while running a polling program.

ERR05: NRZI ENCODING NOT ALLOWED

Select DIRECT.

ERR06: EIA START/STOP PAGE NOT ALLOWED

The Start/Stop function is superceded by a polling program.

ERR07: LINE MUX WITH PAD ONLY

No other display is permitted with PPB operations.

ERR08: MONITOR MODE ONLY

The PAGE 2 (Start/Stop page) FUNCTION field must display the MONITOR selection only.

ERR09: Not defined.

ERR10: Not defined.

ERR11: FOX SYMBOL ONLY IN EBCDIC OR ASCII

The F (fox message) is allowed in EBCDIC and ASCII codes only.

ERR12: TOUT CAN NOT GO TO 2 STEPS

Place the cursor in the right-hand NEXT field and press CLEAR.

ERR13: CODE SYMBOL ONLY IN ASCII

The special message "C" (transmit complete character set) is permitted in ASCII only. ("C" causes the 801B to transmit :32 through :7E.)

ERR14: RECV CAN NOT GO TO 2 STEPS

CLEAR the right-hand NEXT field.

ERR15: OPERAND FIELD IS UNDEFINED

An XMIT, RECV, TOUT, or CNT command lacks the operand field. Locate the offending program line(s) and correct the entry. Remember to press ENTER to close the entry and advance the cursor to the NEXT field.

ERR16: CNT MUST HAVE BOTH NEXT FIELDS

The program branches to the statement indicated by the left-hand NEXT field if the current count is less than the CNT operand; when the count is complete, the program branches to the statement indicated by the right-hand NEXT field. Locate the offending CNT statement and correct the NEXT field entries.

ERR17: NO PROGRAM DEFINED

Do not press SEND to initiate the Poll operation unless a program has been entered.

ERR18: OUT OF BUFFER SPACE

The PPB program's XMIT operands contain too many special symbols (F, fox message; C, character set). Reduce the number of "F" and "C" messages.

ERR19: XMIT NEXT1 INVALID

If an XMIT command uses two NEXT fields, the first NEXT field should point to a RECV or TOUT statement.

ERR20: NEXT FIELD UNDEFINED

ERR21: XMIT NEXT2 INVALID

XMIT NEXT2 should point to a RECV or TOUT statement.

ERR22: BOP CAN'T EXECUTE TWO RECV'S

Polling programs for HDLC and SDLC protocols cannot have both NEXT fields in NOP and XMIT statements pointing to RECV statements. The NEXT fields should point to a single RECV, or to a RECV and TOUT pair.

## B.2 SYSTEM ERROR CODES

ERROR 01: INVALID KEY PRESSED -- when the cursor in on the selection field. To recover, press the correct key.

ERROR 0C: INVALID KEY PRESSED -- when cursor is over an OPEN entry field where only number entries are valid.

# APPENDIX C - TRANSMISSION CODE DESCRIPTIONS

This appendix describes the transmission codes available for use with the 801B Data Monitor. All transmission codes listed below may be used in both synchronous and asynchronous modes. While each of the codes is normally associated with a particular character length, the monitor allows the bit length of each code to be user selected. ASCII, for example, which is normally a seven-bit code, may be programmed for 5, 6, 7, or 8 bit character length.

Transmission code conversion charts are provided as tables C-1 and C-2. The character sets for each code are listed in hexadecimal (HEX) code order. Where a character is not defined in a transmission code the hexadecimal code is repeated for that character. Abbreviations used in this table and in Appendix E may be found in table E-2.

## ASCII

American National Standard Code for Information Interchange (ASCII) is a 7-bit transmission code defined by the American National Standards Institute.

## Baudot

Baudot is the international standard teletype transmission code and is defined as CCITT International Alphabet No. 2. Baudot is a 5-bit, dual case code. The shift characters are letter shift (LS) and figure shift (FS).

## EBCD

Extended binary-coded decimal (EBCD) is a 7-bit dual case code used in IBM 2740 communication terminals. The shift characters are upper case (UC) and lower case (LC).

## EBCDIC

Extended binary-coded-decimal interchange code (EBCDIC) is an 8-bit transmission code developed by IBM.

APPENDIX C

## IPARS

IPARS is a 6-bit transmission code used with International Passenger Airlines Reservation System (IPARS) protocol.

## SBT

Six-bit transcode (SBT) is a six-bit binary-coded decimal transmission code developed by IBM.

## Selectric

Selectric is a 6-bit dual case code. The shift characters are upper case (UC) and lower case (LC).

Table C-1. Transmission Code Conversion Chart

| HEX CODE | ASCII | BAUDOT (FC) | BAUDOT (LC) | EBCD (LC) | EBCD (UC) | EBCDIC | IPARS | SBT | SELECTRIC (LC) | SELECTRIC (UC) |
|---|---|---|---|---|---|---|---|---|---|---|
| 00 | NU | NU | NU | 00 | 00 | NU | 00 | SH | SP | SP |
| 01 | SH | 3 | E | SP | SP | SH | 1 | A | 1 | ! |
| 02 | SX | LF | LF | 1 | = | SX | 2 | B | 2 | @ |
| 03 | EX | - | A | 03 | 03 | EX | 3 | C | 3 | # |
| 04 | ET | SP | SP | 2 | < | PF | 4 | D | 5 | % |
| 05 | EQ | ' | S | 05 | 05 | HT | 5 | E | 7 | & |
| 06 | AK | 8 | I | 06 | 06 | LC | 6 | F | 6 | ¢ |
| 07 | BL | 7 | U | 3 | ; | DE | 7 | G | 8 | * |
| 08 | BS | CR | CR | 4 | : | 08 | 8 | H | 4 | $ |
| 09 | HT | EQ | D | 09 | 09 | RF | 9 | I | 0 | ) |
| 0A | LF | 4 | R | 0A | 0A | MM | 0 | SX | z | Z |
| 0B | VT | BL | J | 5 | % | VT | * | . | 9 | ( |
| 0C | FF | , | N | 0C | 0C | FF | ◢ | < | 0C | 0C |
| 0D | CR | $ | F | 6 | ' | CR | EI | BL | 0D | 0D |
| 0E | SO | : | C | 7 | > | SO | 0E | SB | UC | 0E |
| 0F | SI | ( | K | 0F | 0F | SI | GA | EB | EX | EX |
| 10 | DL | 5 | T | 8 | * | DL | NO | & | t | T |
| 11 | D1 | + | Z | 11 | 11 | D1 | / | J | x | X |
| 12 | D2 | ) | L | 12 | 12 | D2 | S | K | n | N |
| 13 | D3 | 2 | W | 9 | ( | D3 | T | L | u | U |
| 14 | D4 | # | H | 14 | 14 | RE | U | M | e | E |
| 15 | NK | 6 | Y | 0 | ) | NL | V | N | d | D |
| 16 | SY | 0 | P | # | " | BS | W | O | k | K |
| 17 | EB | 1 | Q | 17 | 17 | IL | X | P | c | C |
| 18 | CN | 9 | O | 18 | 18 | CN | Y | Q | l | L |
| 19 | EM | ? | B | 19 | 19 | EM | Z | R | h | H |
| 1A | SB | & | G | 1A | 1A | CC | - | SP | ST | 1A |
| 1B | EC | FS | FS | 1B | 1B | 1B | ǂ | $ | b | B |
| 1C | FS | . | M | UC | UC | IF | SP | * | 1C | 1C |
| 1D | GS | / | X | 1D | 1D | IG | EC | US | IX | 1X |
| 1E | RS | = | V | 1E | 1E | IR | ▶ | ET | 1E | 1E |
| 1F | US | LS | LS | ET | 1F | IU | RG | DL | PE | PF |

0024-81

| HEX CODE | ASCII | EBCD (LC) | EBCD (UC) | EBCDIC | IPARS | SBT | SELECTRIC (LC) | SELECTRIC (UC) |
|---|---|---|---|---|---|---|---|---|
| 20 | SP | @ | ¢ | DS | ▀ | - | ½ | ¼ |
| 21 | ! | 21 | 21 | SS | J | / | m | M |
| 22 | " | 22 | 22 | FS | K | S | . | . |
| 23 | # | / | ? | 23 | L | T | v | V |
| 24 | $ | 24 | 24 | BY | M | U | ' | " |
| 25 | % | s | S | LF | N | V | r | R |
| 26 | & | t | T | EB | O | W | i | I |
| 27 | ' | 27 | 27 | EC | P | X | a | A |
| 28 | ( | 28 | 28 | 28 | Q | Y | o | O |
| 29 | ) | u | U | 29 | R | Z | s | S |
| 2A | * | v | V | SM | : | EC | 2A | 2A |
| 2B | + | 2B | 2B | 2B | < | , | w | W |
| 2C | , | w | W | 2C | HT | % | 2C | 2C |
| 2D | - | 2D | 2D | EQ | EU | EQ | CR | CR |
| 2E | . | 2E | 2E | AK | PA | EX | BS | BS |
| 2F | / | x | X | BL | # | HT | IL | IL |
| 30 | 0 | 30 | 30 | 30 | $ | 0 | j | J |
| 31 | 1 | y | Y | 31 | A | 1 | g | G |
| 32 | 2 | z | Z | SY | B | 2 | = | + |
| 33 | 3 | 33 | 33 | 33 | C | 3 | f | F |
| 34 | 4 | 34 | 34 | PN | D | 4 | p | P |
| 35 | 5 | 35 | 35 | RS | E | 5 | ; | : |
| 36 | 6 | 36 | 36 | UC | F | 6 | q | Q |
| 37 | 7 | , | \| | ET | G | 7 | , | , |
| 38 | 8 | 38 | 38 | 38 | H | 8 | / | ? |
| 39 | 9 | 39 | 39 | 39 | I | 9 | y | Y |
| 3A | : | 3A | 3A | 3A | 3A | SY | 3A | 3A |
| 3B | ; | LF | LF | C3 | . | # | - | _ |
| 3C | < | 3C | 3C | D4 | BS | @ | 3C | 3C |
| 3D | = | EB | EB | NK | EP | NK | HT | HT |
| 3E | > | 3E | 3E | 3E | S2 | EM | 3E | LC |
| 3F | ? | 3F | 3F | SB | S1 | DE | 3F | 3F |

0024-81

| HEX CODE | ASCII | EBCD (LC) | EBCD (UC) | EBCDIC |
|---|---|---|---|---|
| 40 | @ | - | _ | SP |
| 41 | A | 41 | 41 | 41 |
| 42 | B | 42 | 42 | 42 |
| 43 | C | j | J | 43 |
| 44 | D | 44 | 44 | 44 |
| 45 | E | k | K | 45 |
| 46 | F | l | L | 46 |
| 47 | G | 47 | 47 | 47 |
| 48 | H | 48 | 48 | 48 |
| 49 | I | m | M | 49 |
| 4A | J | n | N | ¢ |
| 4B | K | 4B | 4B | . |
| 4C | L | o | O | < |
| 4D | M | 4D | 4D | ( |
| 4E | N | 4E | 4E | + |
| 4F | O | p | P | \| |
| 50 | P | 50 | 50 | & |
| 51 | Q | q | Q | 51 |
| 52 | R | r | R | 52 |
| 53 | S | 53 | 53 | 53 |
| 54 | T | 54 | 54 | 54 |
| 55 | U | 55 | 55 | 55 |
| 56 | V | 56 | 56 | 56 |
| 57 | W | $ | ! | 57 |
| 58 | X | 58 | 58 | 58 |
| 59 | Y | 59 | 59 | 59 |
| 5A | Z | 5A | 5A | ! |
| 5B | [ | NL | NL | $ |
| 5C | \ | 5C | 5C | * |
| 5D | ] | BS | BS | ) |
| 5E | ^ | IL | IL | ; |
| 5F | _ | 5F | 5F | ¬ |

| HEX CODE | ASCII | EBCD (LC) | EBCD (UC) | EBCDIC |
|---|---|---|---|---|
| 60 | \ | 60 | 60 | - |
| 61 | a | & | + | / |
| 62 | b | a | A | 62 |
| 63 | c | 63 | 63 | 63 |
| 64 | d | b | B | 64 |
| 65 | e | 65 | 65 | 65 |
| 66 | f | 66 | 66 | 66 |
| 67 | g | c | C | 67 |
| 68 | h | d | D | 68 |
| 69 | i | 69 | 69 | 69 |
| 6A | j | 6A | 6A | ¦ |
| 6B | k | e | E | , |
| 6C | l | 6C | 6C | % |
| 6D | m | f | F | _ |
| 6E | n | g | G | > |
| 6F | o | 6F | 6F | ? |
| 70 | p | h | H | 70 |
| 71 | q | 71 | 71 | 71 |
| 72 | r | 72 | 72 | 72 |
| 73 | s | i | I | 73 |
| 74 | t | 74 | 74 | 74 |
| 75 | u | 75 | 75 | 75 |
| 76 | v | . | 76 | 76 |
| 77 | w | 77 | 77 | 77 |
| 78 | x | 78 | 78 | 78 |
| 79 | y | 79 | 79 | ` |
| 7A | z | HT | HT | : |
| 7B | { | 7B | 7B | # |
| 7C | ¦ | LC | LC | @ |
| 7D | } | 7D | 7D | ' |
| 7E | ~ | 7E | 7E | = |
| 7F | DE | DE | DE | " |

0024-81

| HEX CODE | EBCDIC |
|---|---|
| 80 | 80 |
| 81 | a |
| 82 | b |
| 83 | c |
| 84 | d |
| 85 | e |
| 86 | f |
| 87 | g |
| 88 | h |
| 89 | i |
| 8A | 8A |
| 8B | 8B |
| 8C | 8C |
| 8D | 8D |
| 8E | 8E |
| 8F | 8F |
| 90 | 90 |
| 91 | j |
| 92 | k |
| 93 | l |
| 94 | m |
| 95 | n |
| 96 | o |
| 97 | p |
| 98 | q |
| 99 | r |
| 9A | 9A |
| 9B | 9B |
| 9C | 9C |
| 9D | 9D |
| 9E | 9E |
| 9F | 9F |

| HEX CODE | EBCDIC |
|---|---|
| A0 | A0 |
| A1 | ~ |
| A2 | s |
| A3 | t |
| A4 | u |
| A5 | v |
| A6 | w |
| A7 | x |
| A8 | y |
| A9 | z |
| AA | AA |
| AB | AB |
| AC | AC |
| AD | AD |
| AE | AE |
| AF | AF |
| B0 | B0 |
| B1 | B1 |
| B2 | B2 |
| B3 | B3 |
| B4 | B4 |
| B5 | B5 |
| B6 | B6 |
| B7 | B7 |
| B8 | B8 |
| B9 | B9 |
| BA | BA |
| BB | BB |
| BC | BC |
| BD | BD |
| BE | BE |
| BF | BF |

| HEX CODE | EBCDIC |
|---|---|
| C0 | { |
| C1 | A |
| C2 | B |
| C3 | C |
| C4 | D |
| C5 | E |
| C6 | F |
| C7 | G |
| C8 | H |
| C9 | I |
| CA | CA |
| CB | CB |
| CC | CC |
| CD | CD |
| CE | CE |
| CF | CF |
| D0 | } |
| D1 | J |
| D2 | K |
| D3 | L |
| D4 | M |
| D5 | N |
| D6 | O |
| D7 | P |
| D8 | Q |
| D9 | R |
| DA | DA |
| DB | DB |
| DC | DC |
| DD | DD |
| DE | DE |
| DF | DF |

| HEX CODE | EBCDIC |
|---|---|
| E0 | \ |
| E1 | E1 |
| E2 | S |
| E3 | T |
| E4 | U |
| D5 | V |
| E6 | W |
| E7 | X |
| E8 | Y |
| E9 | Z |
| EA | EA |
| EB | EB |
| EC | EC |
| ED | ED |
| EE | EE |
| EF | EF |
| F0 | 0 |
| F1 | 1 |
| F2 | 2 |
| F3 | 3 |
| F4 | 4 |
| F5 | 5 |
| F6 | 6 |
| F7 | 7 |
| F8 | 8 |
| F9 | 9 |
| FA | FA |
| FB | FB |
| FC | FC |
| FD | FD |
| FE | FE |
| FF | FF |

## Table C-2. Character to Transmission Code Conversion Chart

AS = ASCII
BF = Baudot (Figure Case)
BL = Baudot (Lower Case)
EB = EBCDIC
EL = EBCD (Lower Case)
EU = EBCD (Upper Case)
IP = IPARS
SB = SBT
SL = Selectric (Lower Case)
SU = Selectric (Upper Case)
nd = Character Not Defined

| Chr. | AS | BF | BL | EB | EL | EU | IP | SB | SL | SU | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 30 | 16 | nd | F0 | 15 | nd | 0A | 30 | 09 | nd | |
| 1 | 31 | 17 | nd | F1 | 02 | nd | 01 | 31 | 01 | nd | |
| 2 | 32 | 13 | nd | F2 | 04 | nd | 02 | 32 | 02 | nd | |
| 3 | 33 | 01 | nd | F3 | 07 | nd | 03 | 33 | 03 | nd | |
| 4 | 34 | 0A | nd | F4 | 08 | nd | 04 | 34 | 08 | nd | |
| 5 | 35 | 10 | nd | F5 | 0B | nd | 05 | 35 | 04 | nd | |
| 6 | 36 | 15 | nd | F6 | 0D | nd | 06 | 36 | 06 | nd | |
| 7 | 37 | 07 | nd | F7 | 0E | nd | 07 | 37 | 05 | nd | |
| 8 | 38 | 06 | nd | F8 | 10 | nd | 08 | 38 | 07 | nd | |
| 9 | 39 | 18 | nd | F9 | 13 | nd | 09 | 39 | 0B | nd | |
| A | 41 | nd | 03 | C1 | nd | 62 | 31 | 01 | nd | 27 | |
| B | 42 | nd | 19 | C2 | nd | 64 | 32 | 02 | nd | 1B | |
| C | 43 | nd | 0E | C3 | nd | 67 | 33 | 03 | nd | 17 | |
| D | 44 | nd | 09 | C4 | nd | 68 | 34 | 04 | nd | 15 | |
| E | 45 | nd | 01 | C5 | nd | 6B | 35 | 05 | nd | 14 | |
| F | 46 | nd | 0D | C6 | nd | 6D | 36 | 06 | nd | 33 | |
| G | 47 | nd | 1A | C7 | nd | 6E | 37 | 07 | nd | 31 | |
| H | 48 | nd | 14 | C8 | nd | 70 | 38 | 08 | nd | 19 | |
| I | 49 | nd | 06 | C9 | nd | 73 | 39 | 09 | nd | 26 | |
| J | 4A | nd | 0B | D1 | nd | 43 | 21 | 11 | nd | 30 | |
| K | 4B | nd | 0F | D2 | nd | 45 | 22 | 12 | nd | 16 | |
| L | 4C | nd | 12 | D3 | nd | 46 | 23 | 13 | nd | 18 | |
| M | 4D | nd | 1C | D4 | nd | 49 | 24 | 14 | nd | 21 | |
| N | 4E | nd | 0C | D5 | nd | 4A | 25 | 15 | nd | 12 | |
| O | 4F | nd | 18 | D6 | nd | 4C | 26 | 16 | nd | 28 | |
| P | 50 | nd | 16 | D7 | nd | 4F | 27 | 17 | nd | 34 | |
| Q | 51 | nd | 17 | D8 | nd | 51 | 28 | 18 | nd | 36 | |
| R | 52 | nd | 0A | D9 | nd | 52 | 29 | 19 | nd | 25 | |
| S | 53 | nd | 05 | E2 | nd | 25 | 12 | 22 | nd | 29 | |
| T | 54 | nd | 10 | E3 | nd | 26 | 13 | 23 | nd | 10 | |
| U | 55 | nd | 07 | E4 | nd | 29 | 14 | 24 | nd | 13 | |
| V | 56 | nd | 1E | E5 | nd | 2A | 15 | 25 | nd | 23 | |
| W | 57 | nd | 13 | E6 | nd | 2C | 16 | 26 | nd | 2B | |
| X | 58 | nd | 1D | E7 | nd | 2F | 17 | 27 | nd | 11 | |
| Y | 59 | nd | 15 | E8 | nd | 31 | 18 | 28 | nd | 39 | |
| Z | 5A | nd | 11 | E9 | nd | 32 | 19 | 29 | nd | 0A | |

| Chr. | AS | BF | BL | EB | EL | EU | IP | SB | SL | SU | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| a | 61 | nd | nd | 81 | 62 | nd | nd | nd | 27 | nd | |
| b | 62 | nd | nd | 82 | 64 | nd | nd | nd | 1B | nd | |
| c | 63 | nd | nd | 83 | 67 | nd | nd | nd | 17 | nd | |
| d | 64 | nd | nd | 84 | 68 | nd | nd | nd | 15 | nd | |
| e | 65 | nd | nd | 85 | 6B | nd | nd | nd | 14 | nd | |
| f | 66 | nd | nd | 86 | 6D | nd | nd | nd | 33 | nd | |
| g | 67 | nd | nd | 87 | 6E | nd | nd | nd | 31 | nd | |
| h | 68 | nd | nd | 88 | 70 | nd | nd | nd | 19 | nd | |
| i | 69 | nd | nd | 89 | 73 | nd | nd | nd | 26 | nd | |
| j | 6A | nd | nd | 91 | 43 | nd | nd | nd | 30 | nd | |
| k | 6B | nd | nd | 92 | 45 | nd | nd | nd | 16 | nd | |
| l | 6C | nd | nd | 93 | 46 | nd | nd | nd | 18 | nd | |
| m | 6D | nd | nd | 94 | 49 | nd | nd | nd | 21 | nd | |
| n | 6E | nd | nd | 95 | 4A | nd | nd | nd | 12 | nd | |
| o | 6F | nd | nd | 96 | 4C | nd | nd | nd | 28 | nd | |
| p | 70 | nd | nd | 97 | 4F | nd | nd | nd | 34 | nd | |
| q | 71 | nd | nd | 98 | 51 | nd | nd | nd | 36 | nd | |
| r | 72 | nd | nd | 99 | 52 | nd | nd | nd | 25 | nd | |
| s | 73 | nd | nd | A2 | 25 | nd | nd | nd | 29 | nd | |
| t | 74 | nd | nd | A3 | 26 | nd | nd | nd | 10 | nd | |
| u | 75 | nd | nd | A4 | 29 | nd | nd | nd | 13 | nd | |
| v | 76 | nd | nd | A5 | 2A | nd | nd | nd | 23 | nd | |
| w | 77 | nd | nd | A6 | 2C | nd | nd | nd | 2B | nd | |
| x | 78 | nd | nd | A7 | 2F | nd | nd | nd | 11 | nd | |
| y | 79 | nd | nd | A8 | 31 | nd | nd | nd | 39 | nd | |
| z | 7A | nd | nd | A9 | 32 | nd | nd | nd | 0A | nd | |
| | 20 | 04 | 04 | 40 | 01 | 01 | nd | 1A | 00 | 00 | Space |
| ! | 21 | 5A | nd | 57 | nd | nd | nd | nd | nd | 01 | Exclamation Point |
| " | 22 | nd | nd | 7F | nd | 16 | nd | nd | nd | 24 | Quote |
| # | 23 | 14 | nd | 7B | 16 | nd | 2F | 3B | nd | 03 | Crosshatch |
| $ | 24 | 0D | nd | 5B | 57 | nd | 30 | 1B | nd | 08 | Dollar Sign |
| % | 25 | nd | nd | 6C | nd | 0B | nd | 2C | 04 | nd | Percent |
| & | 26 | 1A | nd | 50 | 61 | nd | nd | 10 | nd | 05 | Ampersand |
| ' | 27 | 05 | nd | 7D | nd | 0D | nd | nd | 24 | nd | Apostrophe |
| ( | 28 | nd | D2 | 4D | nd | 13 | nd | nd | nd | 0B | Left Parenthesis |
| ) | 29 | 12 | nd | 5D | nd | 15 | nd | nd | nd | 09 | Right Parenthesis |
| * | 2A | nd | nd | 5C | nd | 10 | 0B | 1C | nd | 07 | Asterisk |
| + | 2B | 11 | nd | 4E | nd | 61 | nd | nd | nd | 32 | Plus |
| , | 2C | 0C | nd | 6B | 37 | nd | nd | 2B | 37 | 37 | Comma |
| - | 2D | 03 | nd | 60 | 40 | nd | 1A | 20 | 3B | nd | Hyphen (or Minus) |
| . | 2E | 1C | nd | 4B | 76 | nd | 3B | 0B | 22 | 22 | Period |
| / | 2F | 1D | nd | 61 | 23 | nd | 11 | 21 | 38 | nd | Slash |
| 1/2 | nd | nd | nd | nd | nd | nd | nd | nd | nd | 20 | One-half |
| 1/4 | nd | nd | nd | nd | nd | nd | nd | nd | 20 | nd | One-quarter |
| : | 3A | 0E | nd | 7A | nd | 08 | 2A | nd | nd | 35 | Colon |
| ; | 3B | nd | nd | 5E | nd | 07 | nd | nd | 35 | nd | Semicolon |
| = | 3D | 1E | nd | 7E | nd | 02 | nd | nd | 32 | nd | Equals |
| < | 3C | nd | nd | 4C | nd | 04 | 2B | 0C | nd | nd | Left Angle Bracket (or Less Than) |
| > | 3E | nd | nd | 6E | nd | 0E | nd | nd | nd | nd | Right Angle Bracket (or Greater Than) |

| Chr. | AS | BF | BL | EB | EL | EU | IP | SB | SL | SU | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ? | 3F | 19 | nd | 6F | nd | 23 | nd | nd | nd | 38 | Question Mark |
| @ | 40 | nd | nd | 7C | 20 | nd | nd | 3C | nd | 02 | "At" sign |
| [ | 5B | | | | | | | | | | Left Square Bracket |
| \ | 5C | nd | nd | E0 | | | | | | | Backslash |
| ] | 5D | | | | | | | | | | Right Square Bracket |
| ^ | 5E | | | | | | | | | | Circumflex |
| _ | 5F | nd | nd | 6D | nd | 40 | nd | nd | nd | 3B | Underline |
| ` | 60 | nd | nd | 79 | | | | | | | Accent Grave |
| ´ | | | | 7D | | | | | | | Apostrophe or Accent Acute |
| { | 7B | nd | nd | C0 | | | | | | | Left Bracket |
| \| | 7C | nd | nd | 4F | nd | 37 | | | | | Vertical Line |
| ¦ | 7C* | nd | nd | 6A | | | | | | | Broken Vertical Line |
| } | 7D | nd | nd | D0 | | | | | | | Right Bracket |
| ~ | 7E | nd | nd | A1 | | | | | | | Tilde |
| ¢ | nd | nd | nd | 4A | 20 | nd | nd | nd | nd | 06 | "Cents" sign |
| ¬ | nd | nd | nd | 5F | nd | nd | nd | nd | nd | nd | "Rt. corner" |
| ◢ | nd | nd | nd | nd | nd | nd | 0C | nd | nd | nd | "Ramp" |
| ▶ | nd | nd | nd | nd | nd | nd | 1E | nd | nd | nd | "Triangle" |
| ≠ | nd | nd | nd | nd | nd | nd | 1B | nd | nd | nd | "Slashed-equals" |
| ⊠ | nd | nd | nd | nd | nd | nd | 20 | nd | nd | nd | "Crossed-o" |

| Chr. | AS | BF | BL | EB | EL | EU | IP | SB | SL | SU | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AK | 06 | nd | nd | 2E | nd | nd | nd | nd | nd | nd | ACKnowledge |
| BL | 07 | 0B | nd | 2F | nd | nd | nd | 0D | nd | nd | Bell |
| BS | 08 | nd | nd | 16 | 5D | 5D | 3C | nd | 2E | nd | Backspace |
| BP | nd | nd | nd | 24 | nd | nd | nd | nd | nd | nd | BYP (Bypass) |
| C1 | | | | 1B | | | | | | | Customer Use 1 |
| C2 | nd | nd | nd | 2B | | | | | | | Customer Use 2 |
| C3 | nd | nd | nd | 3B | | | | | | | Customer Use 3 |
| CC | nd | nd | nd | 1A | | | | | | | Cursor Control |
| CN | 18 | nd | nd | 18 | | | | | | | CANcel |
| CR | 0D | 08 | 08 | 0D | nd | nd | nd | nd | 2D | 2D | Carriage Return |
| D1 | 11 | nd | nd | 11 | | | | | | | DC1 (Device Control 1) |
| D2 | 12 | nd | nd | 12 | | | | | | | DC2 |
| D3 | 13 | nd | nd | 13 | | | | | | | DC3 |
| D4 | 14 | nd | nd | 3C | | | | | | | DC4 (EBCDIC also "RA") |
| DE | 7F | nd | nd | 07 | 7F | 7F | nd | 3E | | | DELete |
| DL | 10 | nd | nd | 10 | nd | nd | nd | 1F | | | DLE (Data Link Escape) |
| DS | nd | nd | nd | 20 | | | | | | | Digit Select |
| EB | 17 | nd | nd | 26 | 3D | 3D | nd | 0F | | | EOB (End of Block), or ETB (End Transmission Block) |
| EC | 1B | nd | nd | 27 | | | | | | | ESCape |
| EC | nd | nd | nd | nd | nd | nd | 1D | | | | End of Message, Complete |
| EI | nd | nd | nd | nd | nd | nd | 0D | | | | End of Message Incomplete |
| EM | 19 | nd | nd | 19 | | | | | | | End Medium |
| EP | nd | nd | nd | nd | nd | nd | 3D | | | | End of Message Pushbutton |
| EQ | 05 | 09 | nd | 2D | nd | nd | nd | 2D | | | ENQuiry |
| ER | nd | 03 | 03 | | | | | | | | Error |

| Chr. | AS | BF | BL | EB | EL | EU | IP | SB | SL | SU | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ET | 04 | nd | nd | 37 | 1F | nd | nd | 1E | | | EOT (End Of Transmission) |
| EU | nd | nd | nd | nd | nd | nd | 2D | | | | End of Message Unsolicited |
| EX | 03 | nd | nd | 03 | nd | nd | nd | 2E | 0F | 0F | ETX (End Of Text) |
| FF | 0C | nd | nd | 0C | | | | | | | Form Feed |
| FS | 1C | | | | | | | | | | File or Field Separator |
| FS | | 1B | 1B | | | | | | | | Figure Shift |
| GA | nd | nd | nd | nd | nd | nd | 0F | | | | Go Ahead |
| GS | 1D | | | | | | | | | | Group Separator |
| HT | 09 | nd | nd | 05 | 7A | 7A | 2C | 2F | 3D | 3D | Horizontal Tabulation |
| IA | | | | | | | — | | | | Interchange Address (IPARS Poll) |
| IF | nd | nd | nd | 1C | | | | | | | IFS (Interchange File Separator) |
| IG | nd | nd | nd | 1D | | | | | | | IGS (Interchange Group Separator) |
| IL | nd | nd | nd | 17 | 5E | 5E | nd | nd | 2F | 2F | Idle |
| IR | nd | nd | nd | 1E | | | | | | | IRS (Interchange Record Separator) |
| IU | nd | nd | nd | 1F | | | | | | | IUS (Interchange Unit Separator) |
| IX | nd | nd | nd | nd | nd | nd | nd | nd | 1D | 1D | Index (Linefeed, or platen roll) |
| LC | nd | nd | nd | 06 | 7C | 7C | | | | | Lower Case |
| LF | 0A | 02 | 02 | 25 | 3B | 3B | | | | | Linefeed (Selectric: "IX") |
| LS | nd | 1F | 1F | | | | | | | | Letter Shift |
| NK | 15 | nd | nd | 3D | nd | nd | nd | 3D | | | NAK (Negative Acknowledgement) |
| NL | nd | nd | nd | 15 | 5B | 5B | | | | | New line |
| NO | nd | nd | nd | nd | nd | nd | 10 | | | | No operation. |
| NU | 00 | 00 | 00 | 00 | | | | | | | NULL |
| PA | nd | nd | nd | nd | nd | nd | 2E | | | | Priority Wait List |
| PF | nd | nd | nd | 04 | nd | nd | nd | nd | 1F | 1F | Punch Off |
| PN | nd | nd | nd | 34 | | | | | | | Punch On |
| RE | nd | nd | nd | 14 | | | | | | | REStore |
| RF | nd | nd | nd | 09 | | | | | | | RLF (Reverse Linefeed) |
| RG | nd | nd | nd | nd | nd | nd | 1F | | | | Retransmit, Go Ahead |
| RS | 1E | nd | nd | 35 | | | | | | | Record Separator |
| S1 | nd | nd | nd | nd | nd | nd | 3F | | | | Sync. 1 |
| S2 | nd | nd | nd | nd | nd | nd | 3E | | | | Sync. 2 |
| SB | 1A | nd | nd | 3F | nd | nd | nd | 0E | | | Substitute |
| SH | 01 | nd | nd | 01 | nd | nd | nd | 00 | | | SOH (Start of Heading) |
| SI | 0F | nd | nd | 0F | | | | | | | Shift Indicator |
| SM | nd | nd | nd | 0A | | | | | | | SMM Set Mode |
| SO | 0E | nd | nd | 0E | | | | | | | Shift Out |
| SP | 20 | 04 | 04 | 40 | 01 | 01 | nd | 1A | 00 | 00 | Space |
| SS | nd | nd | nd | 21 | | | | | | | SOS (Start of Significance) |
| ST | nd | nd | nd | nd | nd | nd | nd | nd | 1A | nd | Set Tab |
| SX | 02 | nd | nd | 02 | nd | nd | nd | 0A | | | STX (Start of Text) |
| SY | 16 | nd | nd | 32 | nd | nd | nd | 3A | | | SYN (Synchronous Idle) |
| UC | nd | nd | nd | 36 | 1C | 1C | nd | nd | 0E | nd | Upper Case |
| US | 1F | nd | nd | nd | nd | nd | nd | 1D | | | Unit Separator |
| VT | 0B | nd | nd | 0B | | | | | | | Vertical Tabulation |

# APPENDIX D - X.25 PROTOCOL ANALYSIS

## D.1 GENERAL

X.25 is the number assigned to the CCITT recommendation entitled:

"Interface Between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode on Public Data Networks."

This recommendation defines the physical level (level 1), frame level (level 2), and packet level (level 3) of the interface.

The 801B is equipped to analyze both the frame level and packet level fields of X.25 frames.

## D.2 PHYSICAL LEVEL

The physical level of the interface includes the mechanical, electrical, functional, and procedural characteristics that activate, maintain, and deactivate the physical link between the packet DTE and public data network (PDN) DCE. The X.25 recommendation specifies X.21 or X.21 bis for this level; however, RS-232-C is most commonly used in the United States at this time.

## D.3 FRAME LEVEL

The frame level of the interface provides the procedures for establishing, maintaining, and terminating access to the link between the DTE and the DCE. Two "link access procedures" are defined by the X.25 recommendations: Link Access Procedure (LAP) and Link Access Procedure B (LAPB). Link access procedure B is currently in common use and is preferred for new implementations. The X.25 recommendation calls for high-level data link control (HDLC) transmission; however, binary synchronous communications (BSC or Bisync) is also used. Frame formats for each type of transmission are shown in figure D-1, below.

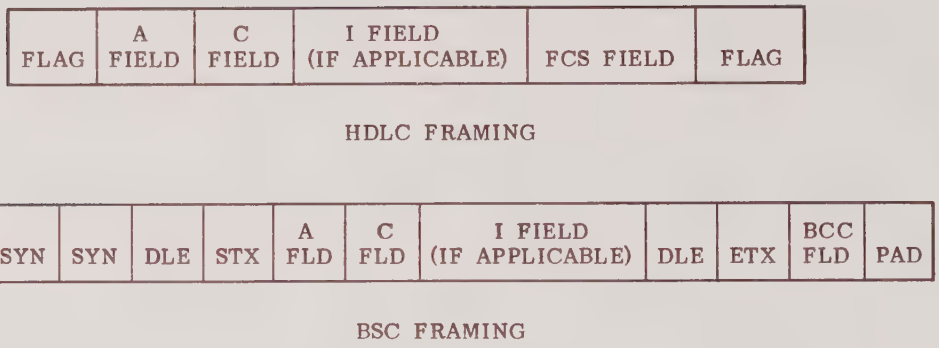



Figure D-1. X.25 Frame Formats

The frame-level fields include the address, control, and frame check sequence (FCS) or block check character (BCC) fields. These fields provide control and management of the data link and, where applicable, provide the communications path for the packet-level fields. In HDLC framing, each frame is preceded and followed by at least one flag. The flags are eight-bit bytes, having the bit pattern 01111110 (:7E), and identify the opening and closing of the frame.

Address Field: The address field is an eight-bit byte consisting of either an address A or address B. Address A has the bit pattern 00000011 (:03). Address B has the bit pattern 00000001 (:01). The address functions are as follows:

- o Address A (:01): Commands from DCE to DTE Responses from DTE to DCE
- o Address B (:03): Commands from DTE to DCE Responses from DCE to DTE

Control Field. The control field is an eight-bit byte that identifies the function performed by the frame (See table D-1). Three types of control functions are provided:

- o Numbered supervisory functions (S frames). Supervisory frames perform link supervisory control.
- o Unnumbered control functions (U frames). Unnumbered frames provide link setup and disconnect control.
- o Numbered information transfers (I frames). Information frames provide packet-level data and control transfers.

Table D-1. Control Field Formats

| FUNCTION | BIT PATTERN (MSB First) | HEXADECIMAL P/F=1 | P/F=0 |
|---|---|---|---|
| Supervisory | | | |
| Receive Ready (RR) Command/Response | Nr P/F 0001 | -1 | -1 |
| Receive Not Ready (RNR) Command/Response | Nr P/F 0101 | -5 | -5 |
| Reject (REJ) Command/Response | Nr P/F 1001 | -9 | -9 |
| Unnumbered | | | |
| Set Asynchronous Response Mode (SARM) Command | 000 P 1111 | 1F | 0F |
| Set Asynchronous Balanced Mode (SABM) Command | 001 P 1111 | 3F | 2F |
| Disconnect (DISC) Command | 010 P 0011 | 53 | 43 |
| Unnumbered Acknowledge (UA) Response | 011 F 0011 | 73 | 63 |
| Disconnected Mode (DM) Response | 000 F 1111 | 1F | 0F |
| Command Reject (CMDR) Response | 100 F 0111 | 97 | 87 |
| Frame Reject (FRMR) Response | 100 F 0111 | 97 | 87 |
| Information | | | |
| Information (I) Command | Nr P Ns 0 | -- | -- |

Where:

P = Poll bit requesting transmission from secondary station.
F = Final bit indicates end-of-transmission from secondary station.
Nr = Receiver sequence count.
Ns = Transmitter sequence count.

Control Field. (Cont.) Each I frame sent across the link is identified by a three-bit transmitter sequence count (Ns) in the control field of the I frame. Received I frames are acknowledged by a three-bit receiver sequence count (Nr) in the control field of the responding I or S frame. Up to seven I frames can be outstanding before acknowledgement. All outstanding I frames, up to and including the last one received, are acknowledged by an Nr equal to the next expected Ns.

Receive Ready (RR) Command/Response

The DTE or DCE issues the RR command to indicate that it is ready to receive an I frame or, by setting the poll bit, to initiate a request for status.

An RR response (issued by the DTE or DCE) acknowledges previously received information frames, responds to an information frame that had the poll bit set, or clears a busy condition (initiated by the transmission of an RNR response).

I frames numbered up to and including Nr-1 are acknowledged by an Nr equal to the next expected Ns.

Receive Not Ready (RNR) Command/Response

Either the DTE or DCE can issue the RNR command/response. An RNR command with the poll bit set initiates a request for status. An RNR response indicates a busy condition; i.e., a temporary inability to accept additional incoming I frames. I frames numbered up to and including Nr-1 are acknowledged by an Nr equal to the next expected Ns. Any following frames are unacknowledged.

Reject (REJ) Command/Response

The DTE or DCE issues an REJ response to request retransmission of I frames starting with frame numbered Nr. Frames up to and including Nr-1 are acknowledged. A reject with the poll bit set initiates a request for status.

Set Asynchronous Response Mode (SARM) Command

This command is associated with LAP and is issued to initiate the asynchronous response mode (ARM). Previously transmitted I frames that are unacknowledged when this command is issued remain unacknowledged. The response to a SARM command is an unnumbered acknowledge (UA) response.

Set Asynchronous Balanced Mode (SABM) Command

This command is associated with LAPB and is issued to place the addressed DTE or DCE in the asynchronous balanced mode (ABM). Previously transmitted I frames that are unacknowledged when this command is issued remain unacknowledged. The response to a SABM command is an unnumbered acknowledge (UA) response.

Disconnect (DISC) Command

The DTE or DCE issues a DISC command to indicate that it is suspending operation. Acceptance of a DISC command is confirmed by an unnumbered acknowledge (UA) response. Upon receipt of the confirmation, the issuing DTE or DCE enters the disconnect phase. Unacknowledged I frames remain unacknowledged.

Unnumbered Acknowledge (UA) Response

The DTE or DCE issues a UA to confirm receipt and acceptance of a SABM or DISC command. The DTE or DCE issuing the SABM or DISC command takes no action until it receives the UA response.

Disconnected Mode (DM) Response

The disconnected mode is part of LAPB. The DTE issues a DM in response to a SABM command, or to any other command that has the poll bit set to 1. This informs the DCE that the DTE is logically disconnected from the link.

Command Reject (CMDR) Response
Frame Reject (FRMR) Response

The DTE or DCE issues these responses to report an error condition that cannot be corrected by retransmission of the frame. Except for the information frames, these responses are the only frames that have an I field. The format of this field is shown in figure D-2.

| OCTET | BIT ORDER 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | X | X | X | X | X | X | X | X | Rejected Frame Control Field |
| 2 | ---Nr--- | | | R | ---Ns--- | | | 0 | State Variable Field |
| 3 | 0 | 0 | 0 | 0 | Z | Y | X | W | Cause Code Field |

1. The Rejected Frame Control Field is the control field of the received frame that initiated the FRMR.

2. State Variable Field format:

   Nr = The three-bit current receive sequence number.
   Ns = The three-bit current send sequence number.

   R = 0 if the rejected frame was a command.
   = 1 if the rejected frame was a response.

3. The Cause Code Field format:

   W = 1 if the control field of the rejected frame was invalid.

   X = 1 if the control field of the rejected frame was considered invalid because the frame contained an information field that was not permitted with the command. Bit W must also be set to 1 with this bit.

   Y = 1 if an information frame and the information field exceeded the capacity of the rejecting station. This bit is mutually exclusive with bit W.

   Z = 1 if the control field of the rejected frame contained an invalid Nr. This bit is mutually exclusive with bit W.

Figure D-2. FRMR I-Field Format

Information (I) Command

Both DTE and DCE issue I commands to transfer sequentially numbered frames, each containing an information field. The content and format of the information fields is described under "Packet Level," Sec. D.4, below.

Frame Check Sequence Field

The frame check sequence (FCS) field follows the control field in supervisory and unnumbered frames or follows the I field in information frames. This 16-bit field contains the result of a cyclic redundancy check (CRC) performed on the data in the frame.

## D.4 PACKET LEVEL

The packet level of the interface provides the procedures for establishing, maintaining, and terminating a virtual call through the network from the local DTE to a remote DTE. These procedures provide for the exchange of control information and user data contained in the information-transfer fields of the information frames. Only one packet is contained in an information-transfer field and only one information-transfer field is contained in an information frame. The format of the header of a typical packet is shown in figure D-3.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | Q | D | Y | Y | X | X | X | X | GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | X | X | X | X | X | X | X | X | Packet-Type Id. |

Where: GFI = General Format Id.
LCGN = Logical Channel Group No.
LCN = Logical Channel No.

Figure D-3. Typical Packet Header Format

The four-bit general format identifier (GFI) identifies the general format of the rest of the packet. This field consists of bits 8 through 5 of the first octet in the packet.

(a) Bit 8 is the qualifier (Q) bit. For user-data transfers, the Q bit is set to 0. The 1 state of this bit is reserved for data packets containing control information as described in CCITT recommendation X.29.

(b) Bit 7 is the delivery-confirmation (D) bit. When set, the calling DTE requests the DCE to produce an acknowledgement of a data packet. On an incoming packet to the called DTE, the D bit indicates that end-to-end acknowledgement of data packets may be employed during the call. The called DTE can also implement the D bit in the call-accepted and call-connected packets in a similar manner.

(c) Bits 6 and 5 (YY) indicate the format of the data in the data packet. The bit assignments are as follows:

00 - Unassigned
01 - Modulo 8 Numbering Sequence
10 - Modulo 128 Numbering Sequence
11 - GFI Extension

The four-bit LCGN identifies the logical-channel group assigned to the virtual circuit on the DTE/DCE interface. This field consists of bits 4 through 1 of the first octet in the packet.

The logical-channel number (LCN) octet identifies the logical channel on the DTE/DCE interface. The LCGN and LCN provide numbering for up to 4095 simultaneous virtual calls on the interface. The DTE assigns these numbers on outgoing calls; the DCE assigns them on incoming calls.

The Packet-Type identifier octet identifies the type of function performed by the packet. A list of the functions and the corresponding codes is provided in table D-2. The functions are described in the text following the table.

Each data packet sent through the virtual circuit is identified by a three-bit packet send-sequence number (Ps) in the Packet-Type identifier of the data packet. Received data packets are acknowledged by a three-bit packet receive-sequence number (Pr) in the packet-type identifier of the responding data packet or flow-control packet. Up to seven data packets can be outstanding before acknowledgement. All outstanding data packets, up to and including the last one received, are acknowledged by a Pr equal to the next expected Ps.

Table D-2. Packet-Type ID Codes

| BIT PATTERN | HEX | PACKET TYPE FROM DTE TO DCE | FROM DTE TO DCE |
|---|---|---|---|
| | | Call Set-up and Clearing | |
| 00001011 | 0B | Call Request Incoming Call | |
| 00001111 | 0F | Call Accepted | Call Connected |
| 00010011 | 13 | Clear Request | Clear Indication |
| 00010111 | 17 | DTE Clear Confirmation | DCE Clear Confirmation |
| | | Data and Interrupt | |
| Pr M Ps 0 | -- | DTE Data DCE Data | |
| 00100011 | 23 | DTE Interrupt | DCE Interrupt |
| 00100111 | 27 | DTE Int. Confirmation | DCE Interrupt Confirmation |
| | | Flow Control and Reset | |
| Pr 00001 | -1 | DTE RR DCE RR | |
| Pr 00101 | -5 | DTE RNR DCE RNR | |
| Pr 01001 | -9 | DTE REJ | |
| 00011011 | 1B | Reset Request | Reset Indication |
| 00011111 | 1F | DTE Reset Confirmation | DCE Reset Confirmation |
| | | Restart | |
| 11111011 | FB | Restart Request | Restart Indication |
| 11111111 | FF | DTE Restart Confirmation | DCE Restart Confirmation |
| | | Diagnostic | |
| 11110001 | F1 | DTE Diagnostic | DCE Diagnostic |

Where: Pr = Packet receive-sequence number
Ps = Packet send-sequence number
M = More-data indicator

Call Request / Incoming Call

The call-request packet is initiated by the calling DTE and is transmitted over the local DTE/DCE interface to the network. At the called DTE the corresponding incoming call packet is received from the network over the remote DTE/DCE interface. The format of these packets is shown in figure D-4. In addition to the packet header, previously described, these packets include address, facilities, and user data sections.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | 0 | D | 0 | 1 | X | X | X | X | GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | Packet-Type Id |
| 4 | X | X | X | X | X | X | X | X | |
| \| | | | | | | | | | - Address Section |
| \| | X | X | X | X | X | X | X | X | |
| \| | 0 | 0 | X | X | X | X | X | X | |
| \| | | | | | | | | | - Facilities Section |
| \| | X | X | X | X | X | X | X | X | |
| \| | X | X | X | X | X | X | X | X | |
| \| | | | | | | | | | - User Data Section |
| n | X | X | X | X | X | X | X | X | |

Figure D-4. Call Request and Incoming Call Packet Format

The address section is of variable length and contains field length indicators for the calling and called DTE addresses and includes the respective addresses.

The facilities section is up to 64 octets in length and contains a field length indicator and, when present, includes the optional facilities fields.

The user data section, of up to 16 octets in length, is passed unchanged to the called DTE.

Call Accepted / Call Connected

The called DTE accepts an incoming call by transmitting a call-accepted packet. At the calling DTE, the corresponding call-connected packet is received from the network. The format of these packets is similar to that of the call-request and incoming-call packets described above. The address and facilities sections in these packets are optional. A user data section is not provided.

Clear Request / Clear Indication

The called DTE can refuse an incoming call by transmitting a clear request to the network. At the calling DTE the corresponding clear indication packet is received from the network. The format of these packets is shown in figure D-5. These packets include a clearing cause as the fourth octet. A list of the clearing cause codes is provided in table D-3. The clear request packet, initiated by the called DTE, contains a clearing cause having the bit pattern 00000000 (:00). Clearing causes for the clear indication packets are issued by the network. A diagnostic code, included as the fifth octet, is optional in the clear-request packet. A list of the diagnostic codes is provided in table D-4. Additional octets in these packets are optional.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | Packet-Type Id |
| 4 | X | X | X | X | X | X | X | X | Clearing Cause |
| 5 | X | X | X | X | X | X | X | X | Diagnostic Code |

Figure D-5. Clear Request and Clear Indication Packet Format

Table D-3. Clearing Cause Codes

| Bit Pattern | HEX | Message |
|---|---|---|
| 00000000 | 00 | DTE Clearing |
| 00000001 | 01 | Number Busy |
| 00000011 | 03 | Invalid Call |
| 00000101 | 05 | Network Congestion |
| 00001001 | 09 | Out of Order |
| 00001011 | 0B | Access Barred |
| 00001101 | 0D | Not Obtainable |
| 00010001 | 11 | Remote Procedure Error |
| 00010011 | 13 | Local Procedure Error |
| 00011001 | 19 | Reverse Charging Not Subscribed |
| 00100001 | 21 | Incompatible Destination |
| 00101001 | 29 | Fast Select Acceptance Not Subscribed |

Table D-4. Diagnostic Codes

| Bit Pattern | HEX | Message |
|---|---|---|
| 00000000 | 00 | No Additional Information |
| 00000001 | 01 | Invalid Ps |
| 00000010 | 02 | Invalid Pr |
| 00010000 | 10 | Packet Type Invalid |
| 00010001 | 11 | For State r1 |
| 00010010 | 12 | For State r2 |
| 00010011 | 13 | For State r3 |
| 00010100 | 14 | For State p1 |
| 00010101 | 15 | For State p2 |
| 00010110 | 16 | For State p3 |
| 00010111 | 17 | For State p4 |
| 00011000 | 18 | For State p5 |
| 00011001 | 19 | For State p6 |
| 00011010 | 1A | For State p7 |
| 00011011 | 1B | For State d1 |
| 00011100 | 1C | For State d2 |
| 00011101 | 1D | For State d3 |
| 00100000 | 20 | Packet Not Allowed |
| 00100001 | 21 | Unidentifiable Packet |
| 00100010 | 22 | Call On One-Way Logical Channel |
| 00100011 | 23 | Invalid Packet Type On Perm. Virtual Circuit |
| 00100100 | 24 | Packet On Unassigned Logical Channel |
| 00100101 | 25 | REJECT Not Subscribed To |
| 00100110 | 26 | Packet Too Short |
| 00100111 | 27 | Packet Too Long |
| 00101000 | 28 | Invalid General Format Identifier |
| 00101001 | 29 | RESTART With Nonzero In Bits 1-4, 9-16 |
| 00101010 | 2A | Packet Type Not Compatible With Facility |
| 00101011 | 2B | Unauthorized Interrupt Confirmation |
| 00101100 | 2C | Unauthorized Interrupt |
| 00110000 | 30 | Timer Expired |
| 00110001 | 31 | For INCOMING CALL |
| 00110010 | 32 | For CLEAR INDICATION |
| 00110011 | 33 | For RESET INDICATION |
| 00110100 | 34 | For RESTART INDICATION |
| 01000000 | 40 | Call Setup Problem |
| 01000001 | 41 | Facility Code Not Allowed |
| 01000010 | 42 | Facility Parameter Not Allowed |
| 01000011 | 43 | Invalid Called Address |
| 01000100 | 44 | Invalid Calling Address |

DTE and DCE Clear Confirmations

The calling DTE acknowledges receipt of a clear-indication packet by transmitting a DTE clear-confirmation packet to the network. The corresponding DCE clear-confirmation packet is received from the network. DCE clear-confirmations can also be originated by the network. The format of these packets is similar to that of the call-request and incoming-call packets described above. The address, facilities, and user-data sections of these packets are optional.

DTE and DCE Data Packets

Once the call has been established, the data transfer phase is entered and the calling DTE can begin transmitting DTE data packets. At the called DTE, the corresponding DCE data packet is received from the network. The format of these packets is shown in figure D-6.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | Q | D | 0 | 1 | X | X | X | X | Q/D/GFI/LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | ---Pr--- | | | M | ---Ps--- | | | 0 | Packet-Type Identifier |
| 4 | X | X | X | X | X | X | X | X | |
| \| | | | | | | | | | - User Data Section |
| n | X | X | X | X | X | X | X | X | |

Figure D-6. DTE and DCE Data Packet Format

A data-qualifier bit (Q) and delivery-confirmation bit (D) are included in the general format identifier of data packets.

The packet-type identifier for the data packets is uniquely identified by a 0 as the least significant bit. In addition, this identifier includes a packet receive-sequence number (Pr), a more-data indicator(M), and a packet send sequence number (Ps).

The more-data indicator is a single bit that is issued by the calling DTE to indicate that the data in this packet will be continued in the next data packet to be transmitted. A 0 bit indicates the current message is completed in this packet.

DTE and DCE Interrupt

An interrupt provides the means of bypassing the normal data packet transmission sequence. The calling DTE initiates a DTE interrupt packet, which is transmitted to the network; at the called DTE the corresponding DCE interrupt packet is received from the network. The format of these packets is shown in figure D-7. The interrupt user-data field is limited to one octet.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | - GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | - LCN |
| 3 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | - Packet-Type Identifier |
| 4 | X | X | X | X | X | X | X | X | - Interrupt User Data. |

Figure D-7. DTE and DCE Interrupt Packet Format

DTE and DCE Interrupt Confirmation

The called DTE acknowledges receipt of a DCE interrupt packet by transmitting a DTE interrupt confirmation packet to the network. At the calling DTE, the corresponding DCE interrupt confirmation is received from the network. The format of these packets is shown in figure D-8.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | Packet-Type Identifier |

Figure D-8. DTE and DCE Interrupt Confirmation Packet Format

DTE and DCE Receive Ready (RR)

Both DTEs on a virtual circuit must periodically transmit a packet to maintain the circuit. If there is no data available for transmission, a DTE receive-ready (RR) packet is initiated by either DTE and transmitted to the network. At the other end of the circuit, the DTE receives the corresponding DCE RR packet from the network. The format of these packets is shown in figure D-9. If the DTE initiating the RR has outstanding data packets that require acknowledgement, the required Pr will be included in this packet.

| OCTET | BIT ORDER 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | ---Pr--- | | | 0 | 0 | 0 | 0 | 1 | Packet-Type Identifier |

Figure D-9. DTE and DCE Receive Ready Packet Format

DTE and DCE Receive not Ready (RNR)

If either DTE on a virtual circuit is temporarily unable to receive additional data packets, it can initiate and transmit an RNR packet. At the other end of the circuit, the DTE receives the corresponding DCE RNR packet from the network. The format of these packets is similar to that of the DTE and DCE RR packets shown in figure D-9. Receipt of data packets is acknowledged by the inclusion of the packet Pr in these packets.

DTE Reject (REJ)

Either DTE on a virtual circuit can request retransmission of one or more consecutive-data packets from the network by initiating and transmitting a DTE reject (REJ). The format of this packet is similar to that of the DTE and DCE RR packets shown in figure D-9. This packet requests retransmission of all data packets starting with the one identified by the Pr included in this packet.

Reset Request / Reset Indication

Either DTE on a virtual circuit can initiate a reset procedure by generating and transmitting a reset request packet. A reset reinitializes the virtual call circuit. At the other end of the circuit, the DTE receives the corresponding reset indication from the network. The format of these packets is shown in figure D-10. The resetting-cause code is included as the fourth octet. A list of the codes is provided in table D-5.

The packet from the DTE issuing the request contains a resetting-cause code having the bit pattern 00000000 (:00). Resetting-cause codes for the reset-indication packets are issued by the network. The optional diagnostic code may be included as the fifth octet. If included in the reset-request packet, this octet will be passed through the network to the remote DTE. A list of the diagnostic codes is provided in table D-4.

| OCTET | BIT ORDER 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | GFI and LCGN |
| 2 | X | X | X | X | X | X | X | X | LCN |
| 3 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | Packet-Type Identifier |
| 4 | 0 | 0 | 0 | 0 | 0 | X | X | X | Resetting Cause |
| 5 | X | X | X | X | X | X | X | X | Diagnostic Code (Optional) |

Figure D-10. Reset Request and Reset Indication Packet Format

Table D-5. Resetting Cause Codes

| Bit Pattern | HEX | Message |
|---|---|---|
| 00000000 | 00 | DTE Reset |
| 00000001 | 01 | Out of Oder |
| 00000011 | 03 | Remote Procedure Error |
| 00000101 | 05 | Local Procedure Error |
| 00000111 | 07 | Network Congestion |
| 00001001 | 09 | Remote DTE Operational |
| 00001111 | 0F | Network Operational |

DTE and DCE Reset Confirmation

The DTE receiving a reset-indication packet acknowledges receipt by initiating and transmitting a DTE reset confirmation. At the other end of the circuit, the DTE receives the corresponding DCE reset confirmation packet from the network. The format of these packets is similar to the DTE and DCE interrupt-confirmation packets shown in figure D-8.

Restart Request and Restart Indication

Either of the DTEs or the network can initiate a restart procedure by transmitting a restart-request packet. A restart simultaneously clears all virtual circuits at the DTE/DCE interface. At the other end of the circuit, the DTE receives the corresponding restart-indication packet from the network. The format of these packets is shown in figure D-11. The restarting-cause code is included as the fourth octet. A list of the codes is provided in table D-6. The packet from the DTE issuing the request contains a restarting-cause code having the bit pattern 00000000 (:00). Restarting-cause codes for restart-indication packets are issued by the network.

| OCTET | BIT ORDER 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | - GFI and LCGN |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - LCN |
| 3 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | - Packet-Type Identifier |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | X | X | - Restarting Cause Code |
| 5 | X | X | X | X | X | X | X | X | - Diagnostic Code (Optional) |

Figure D-11. Restart Request and Restart Indication Packet Format

Table D-6. Restarting Cause Codes

| Bit Pattern | HEX | Message |
|---|---|---|
| 00000000 | 00 | DTE Restart |
| 00000001 | 01 | Local Procedure Error |
| 00000010 | 02 | Link Operational |
| 00000011 | 03 | Network Congestion |

DTE and DCE Restart Confirmation

The DTE receiving a restart indication packet acknowledges receipt by initiating a DTE restart confirmation to the network. At the other end of the circuit, the DTE receives the corresponding DCE restart confirmation. The format of these packets is similar to the DTE and DCE interrupt confirmation packets shown in figure D-8.

DCE Diagnostic

The network can initiate a diagnostic packet to supply information to the DTE on an error situation that is considered unrecoverable at the packet level. The information provided permits an analysis of the error and recovery by higher levels at the DTE, if desired or possible. The format of this packet is shown in figure D-12. The diagnostic code is included as the fourth octet. A list of the codes is provided in table D-4, above.

If the diagnostic packet is issued in response to an erroneous packet from the DTE, the fifth through seventh octets will contain the header from the erroneous packet. No confirmation of a receipt of a diagnostic packet need be issued by the DTE. Following issuance of a diagnostic packet, the DCE maintains the logical channel, to which the diagnostic was related, in the same state it was in at the time the packet was generated.

| | BIT ORDER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| OCTET | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | - GFI and LCGN |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - LCN |
| 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | - Packet Type Identifier |
| 4 | X | X | X | X | X | X | X | X | - Diagnostic Code |
| 5 | X | X | X | X | X | X | X | X | - Diagnostic Information |

Figure D-12. DCE Diagnostic Packet Format

# APPENDIX E - DEFAULT POLLING PROGRAMS

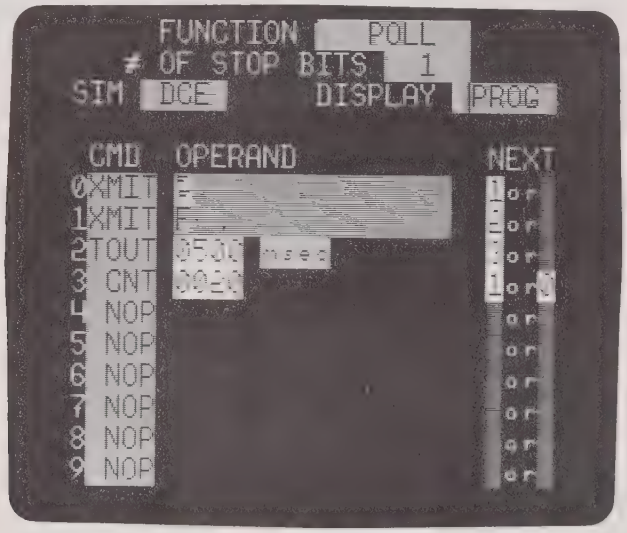
## E.1 GENERAL

This Appendix discusses the 801B's default polling programs. The programs are listed in the order given on the PRINTER/POLL and BERT MENU pages. To modify the polling program, place the cursor in the operand to be modified, and press [CLEAR] to delete the string (in XMIT or RECV operands).

Use the tables in Appendix B to find the hex code for the transmitted and received messages.

## E.2 ASYNC PROTOCOL

ASYNC Menu Selection #1. Printer Test Program




Line #0. DCE (801B) transmits a form feed.

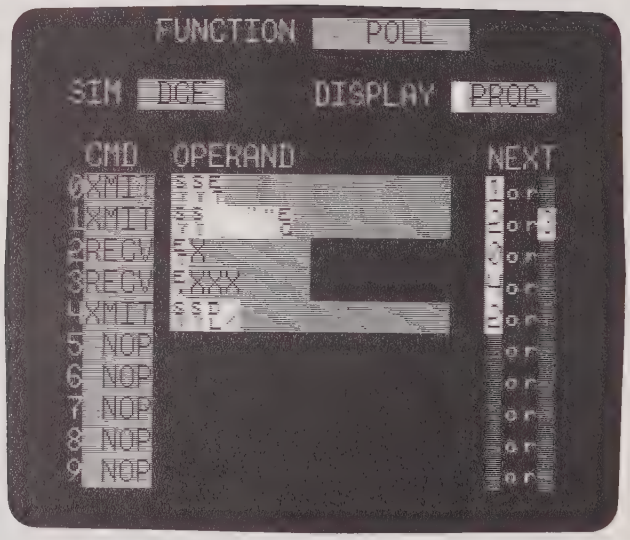
Line #1. DCE transmits the "fox" message.

Line #2. DCE waits for 500 milliseconds.

Line #3. 801B increments counter; if the count is less than 20, the program returns to line #1; on the 20th count the entire program is repeated.

## E.3 SYNC PROTOCOL

SYNC 3270 Menu Selection #2. General Poll




Line #0. DCE (801B) transmits line clearing message.

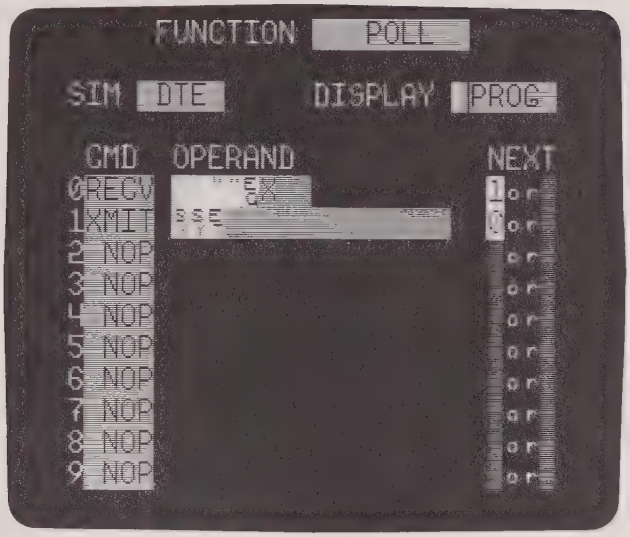
Line #1. DCE transmits the general polling message--a two-byte Station Select Address, another two-byte address, and the <ENQ>.

Line #2. If the DTE (the device under test) transmits EOT (the "no data" reply), the program returns to statement #0. -OR-

Line #3. The program executes this line if the DTE transmits data. 801B RECV statement "looks for" the <ETX>, <BCC>, <BCC>, and <PAD> characters that terminate a data transmission.

Line #4. DCE transmits ACK 1, then returns to statement #2.

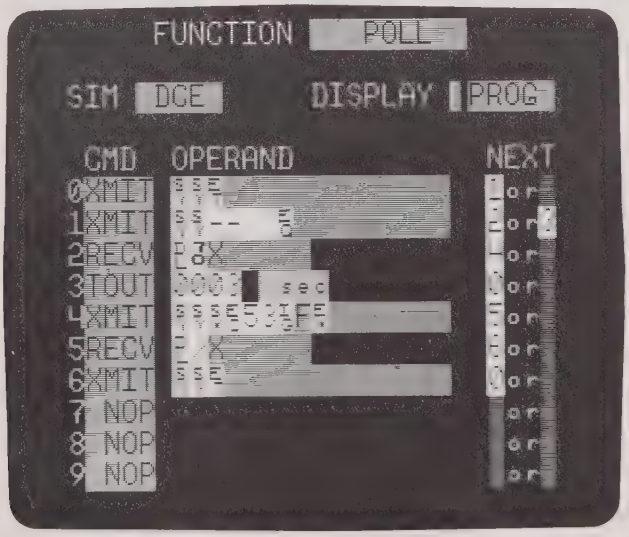
SYNC 3270 Menu Selection #3. Respond to Poll




Line #0. DTE (801B) receives the incoming general poll from the DCE.

Line #1. DTE transmits <EOT>, the "no data" reply, then returns to statement #1.

SYNC 3270 Menu Selection #4. Select Display




Line #0. DCE (801B) transmits line clearing message.

Line #1. DCE transmits the select polling message.

SYNC Select Display (cont.)

Line #2. If the DTE (device under test) acknowledges (<ACK0>), the program advances to line #4.
-Or-

Line #3. If the DTE fails to acknowledge within 3 seconds. In this case, the DCE retransmits the line clearing message and poll (program lines #0 and #1).

Line #4. DCE transmits terminal (or printer) control characters, followed by the "fox" message, and finally, <ETX>. (<BCC> characters are appended automatically.)

Line #5. DTE acknowledges (<ACK1>).

Line #6. DCE transmits another line clearing message (a reply to the DTE's <ACK1>); the program returns to line #0.

SYNC 3270 Menu Selection #5. Select Printer

This program is identical to selection #4, with the exception of lines #1 and #4. Line #1 provides a different device address, and line #4 provides specific instructions to the device (position cursor, form feed, etc.).

SYNC X.25 Menu Selections.

See the HDLC polling programs, Sec. E.6, page E-8, for the program logic.

The 801B's SYNC (bisync) X.25 programs are identical to those for HDLC, with the following exceptions:

1. Bisync embeds the A-, C-, and I-fields with the control characters <SYN>, <DLE><STX>, and <DLE><ETX>.

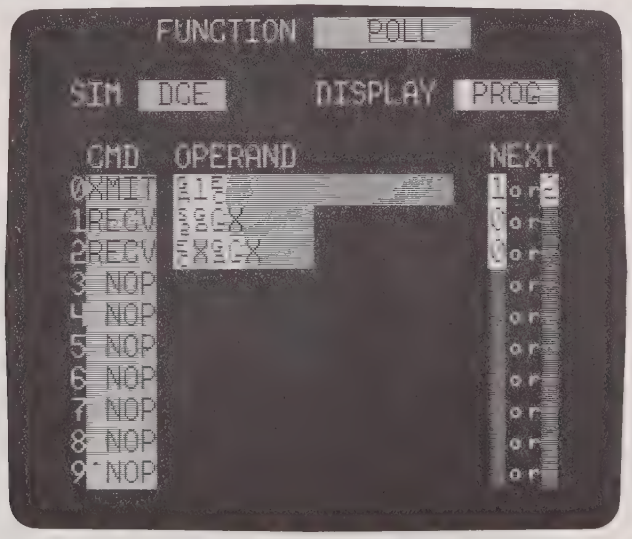
2. The RECV operand must be entered in hex, rather than binary.

For a comparison of HDLC and Bisync framing, see figure D-1, page D-2.

## E.4 IPARS PROTOCOL

Note: the 801B automatically precedes each transmission with the IPARS sync characters, "S1-S2" ( <:3F> and <:3E> ).

IPARS Menu Selection #1. Poll w/ Response

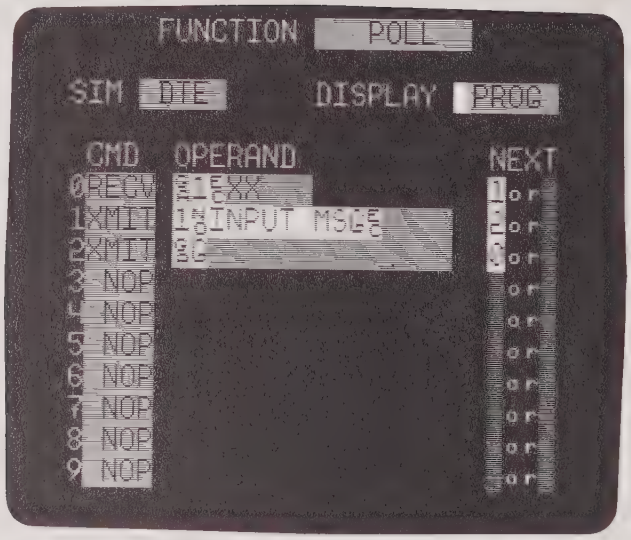



Line #0. DCE (801B) polls DTE.

Line #1. DTE (device under test), having no data, responds with "Go Ahead" message.
-Or-

Line #2. DTE responds with data, followed by "Go Ahead." (The 801B program "looks for" the <EOM-Complete> and <BCC> behind the data.)

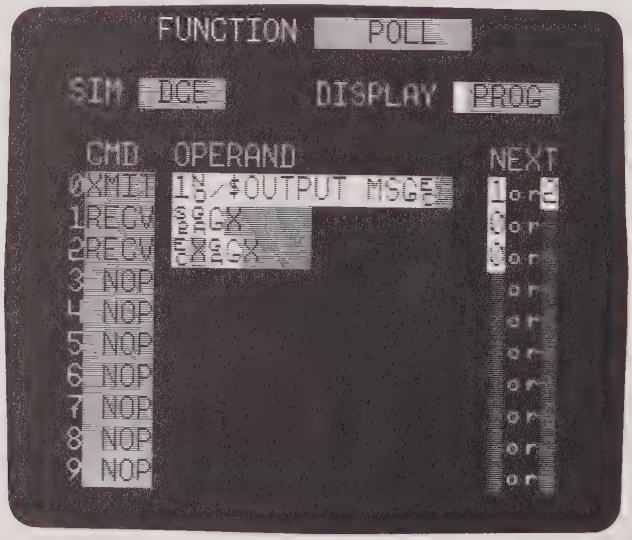
IPARS Menu Selection #2. Respond to Poll




Line #0. DTE (801B) receives polling message from DCE.

Line #1. DTE (801B) sends data, followed by "Go Ahead" (line #2).

IPARS Menu Selection #3. Output Message




Line #0. DCE (801B) sends output message to DTE. "/"=:11=Erase/Write command, "$"=:30="Write on line #1."

Line #1. DTE (device under test) responds with "Go Ahead" message (no data).
-Or-

Line #2. DTE responds with data, followed by "Go Ahead."

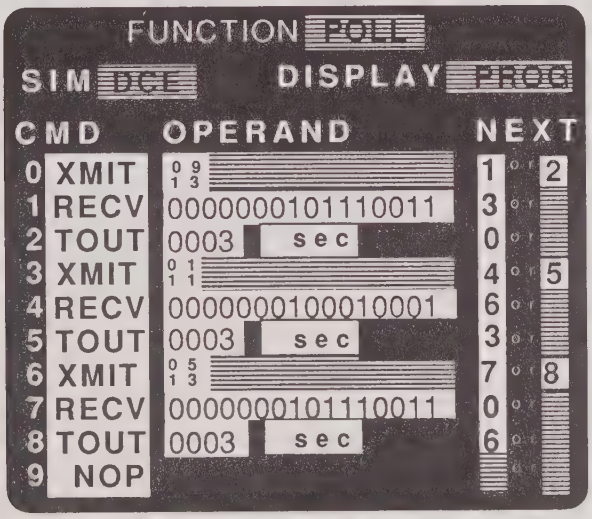
## E.5 SDLC PROTOCOL

In the text below, the descriptions for the RECV operand for SDLC and HDLC (bit-oriented protocols) show only the 8-bit address and control fields (total 16 bits). In actual transmissions, these two bytes ("octets") are, of course, preceded by a flag character and followed by an FCS byte.

The 801B automatically begins each transmission (XMIT operand) with flag characters <:7E>, and appends frame check sequence (FCS) bytes followed by flag characters.

Note: In the SDLC programs, the default secondary station address is :01. Operator must select any other value if necessary.

SDLC Menu Selection #1. Poll




Line #0. Primary station (801B--in this case configured as DCE) sets the secondary station (device under test--station address: :01) to normal response mode (SNRM,P<off>).

Line #1. Secondary station acknowledges (UA,F<on>); go to line #3.
-Or-
Line #2. Times out; repeat line #0.

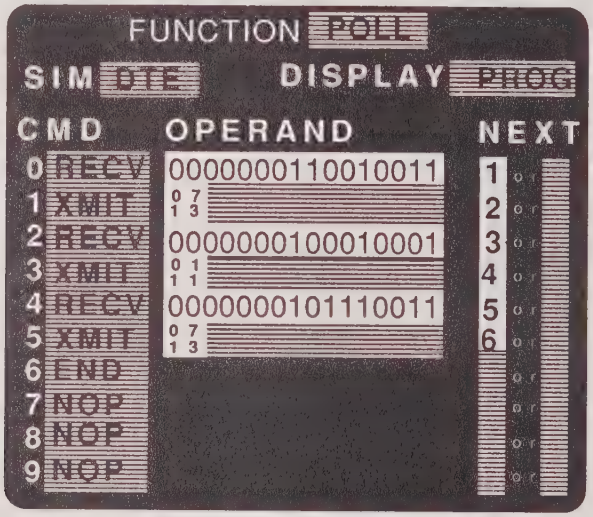
Line #.3 Primary station polls secondary for transmission (RR,P<on>).

Line #4. Secondary has nothing to transmit (RR,F<onf>); go to line #6.
-Or-
Line #5. Times out; repeat line #3.

Line #6. Primary station disconnects secondary (DISC,P<on>).

Line #7. Secondary acknowledges (UA,F<on>); repeat the program.
-Or-
Line #8. Times out; primary station retransmits DISC command.

SDLC Menu Selection #2. Respond to Poll




Line #0. Primary station (device under test--in this example, DCE) sets secondary (801B; address :01) to normal response mode (B,SNRM,P<on>).

Line #1. Secondary acknowledges (B,UA,F<on>).

Line #2. Primary polls secondary for transmission (B,RR,P<on>).

Line #3. Secondary has nothing to transmit (B,RR,F<on>).

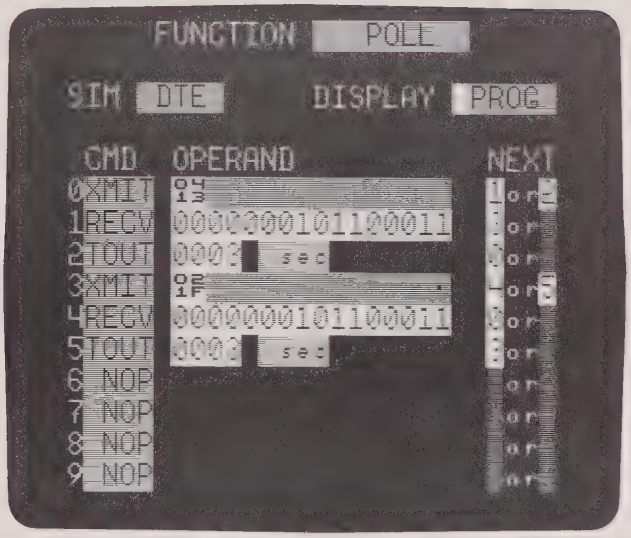
Line #4. Primary disconnects secondary (B,DISC,P<on>).

Line #5. Secondary acknowledges (B,UA,F<on>).

## E.6 HDLC PROTOCOL

Note: The following text describes the polling programs for both HDLC and bisync X.25, as discussed above in Sec. E.3.

HDLC Menu Selection #1. LAPB - SIM DTE



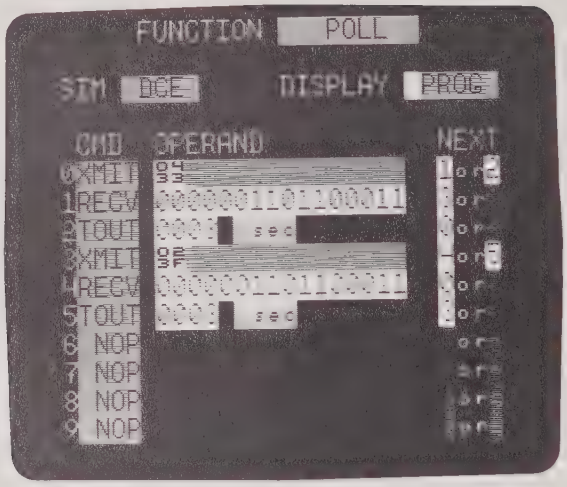

Line #0. DTE (801B) commands DCE to disconnect link (B,DISC,P<off>).

Line #1. DCE (device under test) acknowledges (B,UA,F<off>). Program continues with statement #3. -OR- Line #2. DTE retransmits if no acknowledgement from DCE within 3 seconds.

Line #3. DTE commands DCE to set asynchronous balanced mode (B,SABM,P<off>).

Line #4. DCE (device under test) acknowledges (B,UA,F<off>). Program repeats.
-OR-
Line #5. Times out. Routine returns to line #3.

HDLC Menu Selection #2. LAPB - SIM DCE




Line #0. DCE (801B) commands DTE to disconnect link. (A,DISC,P<off>).

Line #1. DTE (device under test) acknowledges (A,UA,F<off>). Program continues with statement #3.

-Or-

Line #2. If no acknowledgement from DTE within 3 seconds, DCE retransmits DISC command.

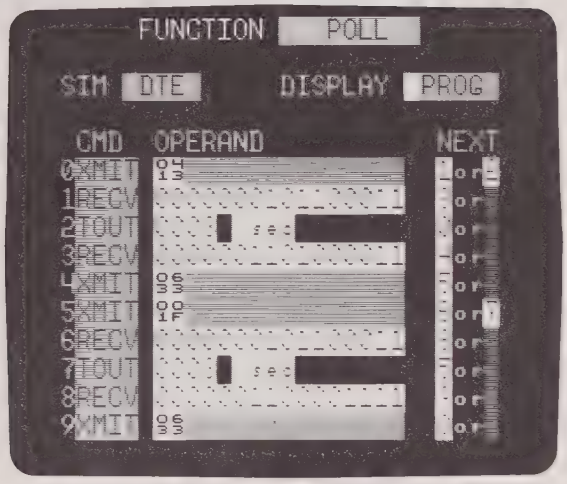
Line #3. DCE commands DTE to set asynchronous balanced mode (A,SABM,P<off>).

Line #4. DTE acknowledges (A,UA,F<off>). Program repeats.

-Or-

Line #5. If no acknowledgement from DTE within 3 seconds, DEC retransmits SABM command.

HDLC Menu Selection #3. LAP - SIM DTE




Line #0. DTE (801B) commands DCE to disconnect link (B,DISC,P<off>).

Line #1. DCE (device under test) acknowledges (B,UA,F<off>). Program continues with statement #3.

-Or-

Line #2. Times out; repeat line #0.

Line #3. DCE commands DTE to disconnect link (A,DISC,P<off>).

Line #4. DTE acknowledges (A,UA,F<off>).

Line #5. DTE commands DCE to set asynchronous response mode (B,SARM,P<off>).

Line #6. DCE acknowledges (B,UA,F<off>). Program advances to line 8.

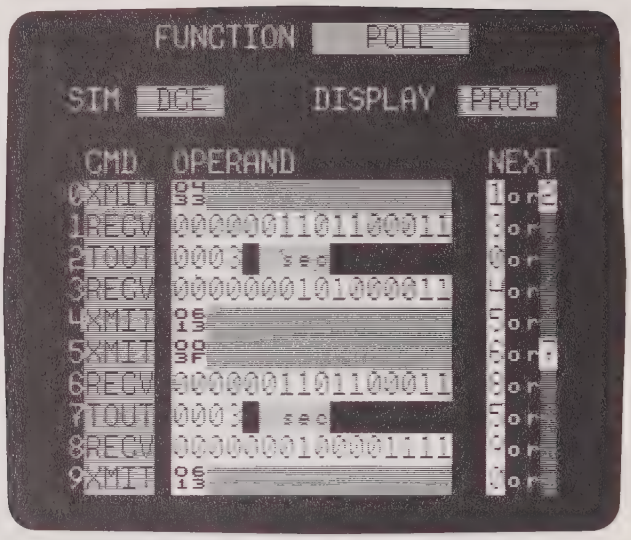
-Or-

Line #7. Times out; repeat line 5.

Line #8. DCE commands the DTE (801B) to set asynchronous response mode (B,SARM,P<off>).

Line #9. DTE (801B) issues unnumbered acknowledgement (B,UA,F<off>). Program repeats. Line #9. DTE acknowledges ((A,UA,F<off>). Program repeats.

HDLC Menu Selection #4. LAP - SIM DCE




Line #0. DCE (801B) commands DTE to disconnect link (A,DISC,P<off>).

Line #1. DTE (device under test) acknowledges (A,UA,F<off>). Program continues with statement #3.
-Or-

Line #2. Program times out. Repeat line #0.

Line #3. DTE commands DCE to disconnect link (B,DISC,P<off>).

Line #4. DCE (801B) acknowledges (B,UA,F<off>).

Line #5. DCE commands DTE to set asynchronous response mode (A,SARM,P<off>).

Line #6. DTE acknowledges (A,UA,F<off>).
-Or-

Line #7. Time expires. Repeat #5.

Line #8. DTE commands DCE to set asynchronous response mode (B,SARM,P<off>).

Line #9. DCE Acknowledges; program repeats.

# APPENDIX F - RS-232-C INTERFACE

## Table F-1 EIA RS-232-C Interface Connector Pin Assignments

| PIN NUMBER | CIRCUIT | CCITT EQUIVALENT | DESCRIPTION |
|---|---|---|---|
| 1 | AA | 101 | Protective ground |
| 2 | BA | 103 | Transmitted data |
| 3 | BB | 104 | Received data |
| 4 | CA | 105 | Request to send |
| 5 | CB | 106 | Clear to send |
| 6 | CC | 107 | Data set ready |
| 7 | AB | 102 | Signal ground (common return) |
| 8 | CF | 109 | Received line signal detector |
| 9 | — | | (Reserved for data set testing) |
| 10 | — | | (Reserved for data set testing) |
| 11 | | | Unassigned |
| 12 | SCF | 122 | Secondary received line signal detector |
| 13 | SCB | 121 | Secondary clear to send |
| 14 | SBA | 118 | Secondary transmitted data |
| 15 | DB | 114 | Transmission signal element timing (DCE source) |
| 16 | SBB | 119 | Secondary received data |
| 17 | DD | 115 | Receiver signal element timing (DCE source) |
| 18 | | | Unassigned |
| 19 | SCA | 120 | Secondary request to send |
| 20 | CD | 106.2 | Data terminal ready |
| 21 | CG | 110 | Signal quality detector |
| 22 | CE | 125 | Ring indicator |
| 23 | CH/CI | 111/112 | Data signal rate selector (DTE source) |
| 24 | DA | 113 | Transmit signal element timing (DTE source) |
| 25 | | | Unassigned |

## Table F-2. Interchange Logic States

| NOTATION | INTERCHANGE VOLTAGE (3 TO 25 VOLTS) | |
|---|---|---|
| | NEGATIVE | POSITIVE |
| Binary state | 1 | 0 |
| Signal condition | Marking | Spacing |
| Function | OFF | ON |
| Current loop | Current | No current |
| Indication | Red | Green |

# RAMpak$^{tm}$

## 1. GENERAL

The RAMpak$^{tm}$ module option enlarges the data capture memory available in the 801B Data Link Monitor. The module contains 256K bytes of add-on memory. This memory supports the saving of programs and captured data.

It is possible to retrofit 801B units (serial number 50001 or higher) with the RAMpak$^{tm}$.

## 2. PHYSICAL

The RAMpak$^{tm}$ has an internal battery power source to maintain the stored data after the 801B's power is turned off. The battery life is four to five years. Return the unit to CXR Telcom for battery replacement.

The RAMpak$^{tm}$ is housed in a metal case which has three locking pins to secure it to the pack panel of the 801B. You can remove the Rampak$^{tm}$ from the 801B, even with power applied, without damaging either piece of equipment. However, we recommed that you do not remove the RAMpak$^{tm}$ with power applied; you may lose data.

## 3. DATA STORAGE

The RAMpak$^{tm}$ memory is divided into two areas:

a. Progam and configuration (16k bytes)
b. Capture buffer (240k bytes)

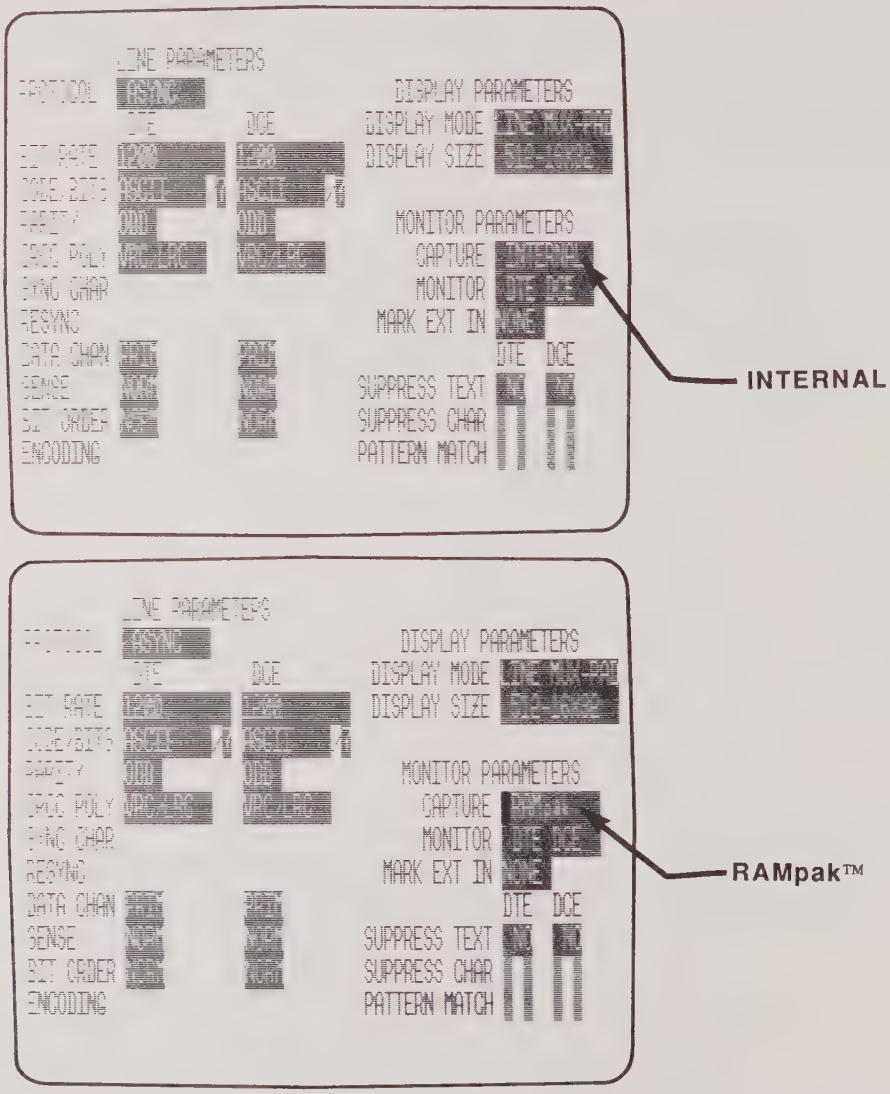
The RAMpak$^{tm}$ is a storage device, programs are not run from it. You can save up to 14 programs within the RAMpak$^{tm}$. You can recall one or all of the programs from the RAMpak$^{tm}$ back into the 801B main program memory.

### Communication Session

You can save one communication session (with a maximum of 240k bytes) in the memory. The protocol configuration of the line under test is also saved to denote the type of data stored.

4. SWITCHING

Use the LINE/DISPLAY PAGE to switch between the INTERNAL or RAMpak[tm] capture buffers. You can save data in the RAMpak[tm] and still use the internal RAM of the 801B for additional testing.



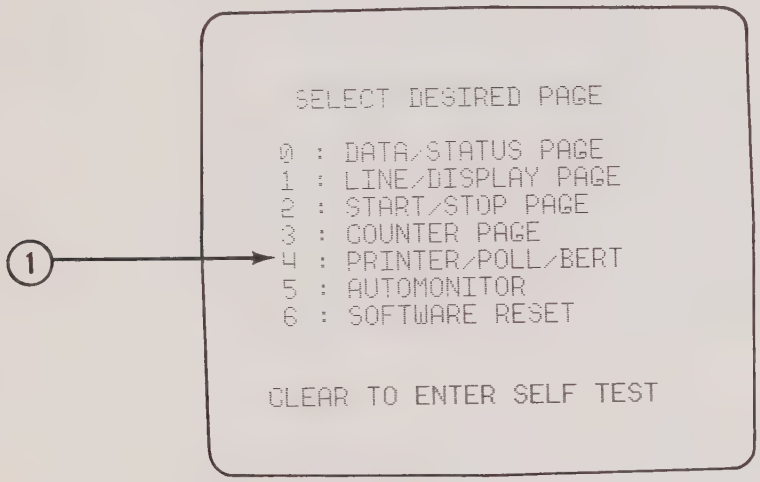

Switch between INTERNAL and RAMpak[tm] modes with the CAPTURE selection. In the RAMpak[tm] mode, use standard 801B commands to view captured data.

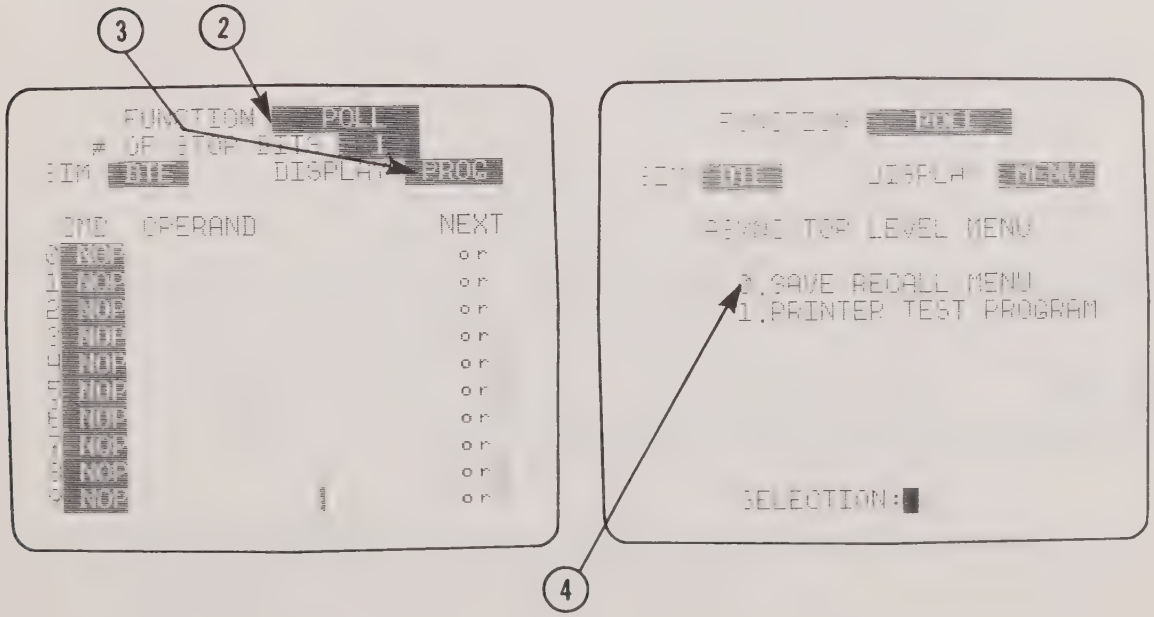
If you are about to save capture data over information already in the RAMpak[tm] the screen displays the warning: "RAMpak BUFFER HAS DATA PRESS RUN TO OVERWRITE, CAPTURE TO EXIT".

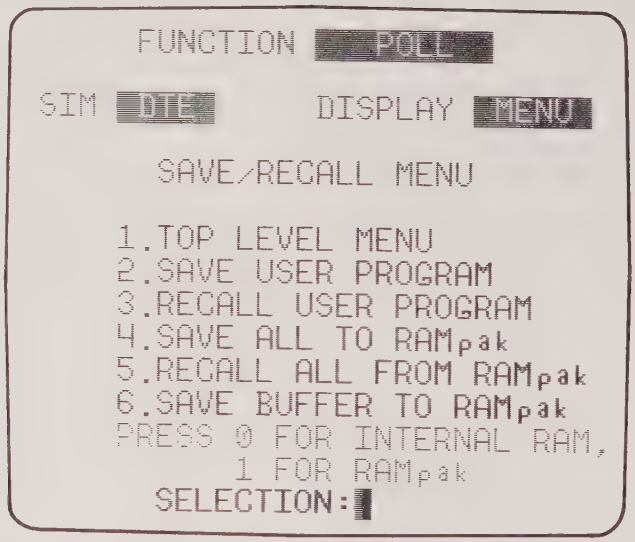
## 5. SAVE/RECALL

You can recall ALL of the programs from the RAMpak[tm] into the internal memory of the 801B. Gain access to selected programs the standard way (Sec. 4.6), after you've loaded the program into the internal memory from the SAVE/RECALL menu.

1) On the SELECT DESIRED PAGE menu, select page 4:PRINTER/POLL/BERT.
2) Move the cursor to FUNCTION and press [ENTER] to select POLL
3) Move the cursor to DISPLAY and press [ENTER] to select MENU.
4) Select item 0 to display the SAVE/RECALL menu.






Item one (1) takes you back to the TOP LEVEL POLL PROGRAM menu.

Items two (2) or three (3) are for saving or loading user programs. If you select these, you get another menu.

ENTER PROGRAM #(1-E)

After the program is picked you are prompted again with:

PRESS 0 FOR INTERNAL RAM
1 FOR RAMpak[tm]

The program is transferred when you make the last selection.

When you select items four (4), five (5), or six (6), "TO WRITE TO RAMpak, PRESS F TO CONTINUE" appears. The new data will write over the top of the data in the RAMpak[tm].

Items four (4) and five (5) are for saving or loading ALL of the programs between the internal memory and the RAMpak[tm].

Item six (6) saves the internal capture buffer into the RAMpak[tm].

Press [CLEAR] on the SELECT DESIRED PAGE menu to bring up the SELF TEST MENU.

```
      801B SELF TEST MENU
         ENTER TEST#

 1  REVISION REPORT
 2  PROCESSOR TIMER
 3  SYSTEM RAM
 4  PROGRAM RAM
 5  VIDEO RAM
 6  WRITE/READ RAM LOOP
 7  KEYPAD/VIDEO DISPLAY
 8  RAM PACK RAM TEST

PRESS CLEAR TO TERMINATE TEST
       PAGE TO ENTER MONITOR
```

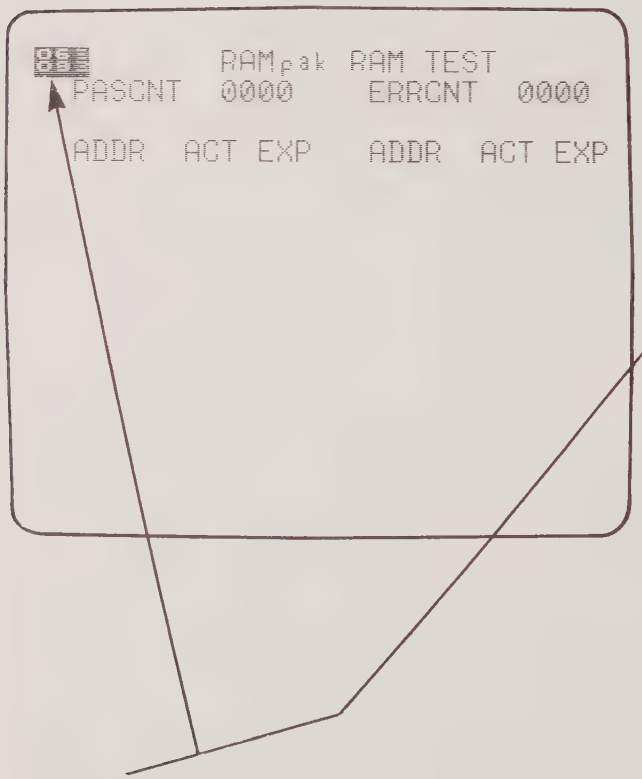
Item one (1) is the REVISION report page.

```
      801B REVISION  2.13

     RELEASE DATE 02/27/86

    SYSTEM CHECKSUM = 1C0A

     CMOS  CHECKSUM = E9BE

  RAM PACK CHECKSUM = E9BE
```

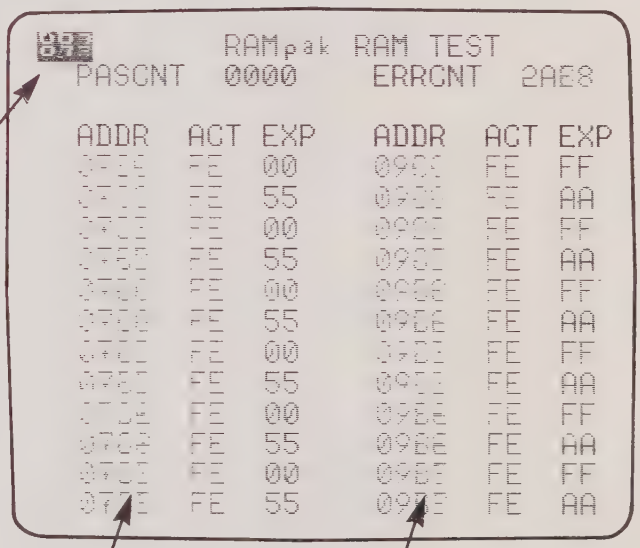
When the RAMpak[tm] is not installed this page displays "RAMpak[tm] CHECKSUM = NONE". Normal (not flashing) display of the CHECKSUM means the item passed the self test.

Item eight (8) is the RAMpak[tm] RAM TEST. This test verifies that the RAMpak[tm] is working correctly. This checks each 8k CMOS memory IC within the RAMpak[tm].

(WITH RAMpak[tm])




(RAMpak[tm] not installed)




The absolute RAMpak[tm] address is in the upper left corner.

Errors flash in reverse video

Zero ERRCNT means test passed.

# INDEX


# OF STOP BITS field, 4-8
20, 40, or 60 mA terminal posts, 2-6
2740 terminals, C-1
50 or 60 Hz operation, setting the CRT for, 3-36

A FIELD BYTES field, 3-24
A field, 3-24, 3-25, D-4, E-7
A STRING field, 3-24
ABM, D-5
Access barred packet, 5-5
ACK message, 6-4
ACTIVE slide switch, 2-6
ACTual values, memory self-test, 3-36
Address A or Address B, D-2
ADDRess field, self-test, 3-36
ADR, 7-5
American National Standard Code for Information Interchange, see ASCII.
ANALYZE key, 2-3, 5-2, 6-2, 7-1
ARM, D-4
ASCII
- character set, transmitting, (FUNCTN C), 2-3
- code, 3-14, 3-15, 6-1, C-1
Asynchronousl2vpsblOH
- balanced mode, see ABM.
- response mode, see ARM.
ASYNChronous protocol, 3-13, 3-14, 4-4
Automonitor, 3-1
- display, 3-3
- mode, 3-3, 3-4

B STRING field, 3-24
Bad BCC, 2-3
Basic
- Information Unit, see BIU.
- Link Unit, see BLU.
- Transmission Unit, see BTU.
Battery, internal, 2-8
BAUDOT code, 3-14, 3-16, C-1
BCC characters, 1-2, 6-2, D-2
BCN, 7-7
Beacon frame, see BCN.
BERT, 4-2, 4-4
Binary numbers, entering, 3-15, 3-25
Bisync
- code, D-1
- protocol, 3-13, 3-15
BIT
- ORDER field, 3-16
- RATE field, 3-13
- - BERT test, 4-4
- SHIFT key, 2-4, 3-7, 3-11
Bit
- error rate test, see BERT.
- oriented protocol, 3-15, 3-20
- per character, selecting, 3-14
- shift operation, 3-11
BITS field, 3-14
BIU, 7-5
Blinking
- hex numbers, 4-11
- underline, see Underline.
Block check character, see BCC.
BLOCK counter, 2-27
BLU, 7-5
Breakout box, 3-1, 4-5
Bright intensity display, 3-6, 3-33, 3-34, 6-2
BSC, see Bisync.
BTU, 7-5
Burroughs protocol, 3-13
Busy condition, X.25 protocol, D-4

C FIELD BITS field, 3-24
C field, 3-24, 3-25, D-2, D-3, D-6, E-7
C STRING field, 3-24
Call
- accepted packet, 5-4, D-10
- connected packet, 5-5, D-10
- request packet, 3-23, 5-4, D-10
CAPTURE key, 2-3, 3-1, 3-8, 3-34, 4-4, 4-11, 6-2, 7-1, 7-3
Capture
- buffer, 2-3, 3-1, 6-1, 7-2, 7-3
- mode, 3-8, 3-21, 4-5
CCITT recommendation X.29, D-7
CCITT-16, selecting, 3-14
CFGR, 7-7
CHARACTER
- counter, 3-27
- SET field, 3-36
Character set, B-3
- transmitting (FUNCN C), 4-12
CLEAR key, 2-4, 3-14, 3-15, 3-35, 4-4
Clear
- confirmation packet, 5-6, D-13
- indication packet, 5-1, 5-5, D-11, D-13
- request packet, D-11, 5-5
Clearing cause, D-11
CLK external input, 2-2

CMDR, 5-4, D-5
CNT (Count) statement, 4-13
CODE
- /BITS field, 3-14
- /HEX key, 2-2, 3-7, 3-9, 3-36, 5-2, 6-2, 7-3
- selection, B-1
Command Reject, see CMDR.
Complete Segment, see CS.
CONFIG key, 2-3, 2-8, 3-20
Configuration frame, see CFGR.
Consecutive-data packets, D-15
Control field, see C Field.
COUNTER page, 3-26
Counters, Enabling/Disabling, 3-27
CRC, D-6
CRC-16, selecting, 3-14
CRC-6, selecting, 3-14
CRCC POLYnomial field, 3-14
CRCC, B-1
CRLP selection, 3-16. See also Current Loop.
CRT
- adjusting brightness and contrast, 3-36
- changing for 50 or 60 Hz operation, 3-36
CS, 7-6
Current loop circuits
- interfacing to, 2-6
- monitoring, 3-16, B-1
Cursor control keys, 2-4, 3-10
CURsor field, 3-36
Cyclical Reduncancy check, see CRC and CRCC.

D Bit, 5-1, D-7, D-13
DA, 7-5
Data
- BIT ORDER field, 3-16
- count field, see DC.
- ENCODING field, 3-16
- entry fields, 3-12, 3-14, 3-15
- flow control, see DFC.
- message, 6-5
- packet, 5-2, 5-6, D-13
- suppressingH
- - in DDCMP, 6-2
- - in SNA, 7-3
DATA CHANnel field, 3-16
DC, 7-5
DCE data, (reverse video display), 3-6, 3-36
DDCMP
- analysis, 6-1
- protocol, 3-13
Decimal numbers, entering, 3-15
DECNET@, 6-1, 6-3
Delivery-confirmation bit,see D bit.
Destination address field, see DA.
DFC, 7-6
Diagnostic
- code, D-11, D-12, D-15, D-17
- packet, D-17, D-18
Digital Equipment Corporation@, 6-1, 6-3
DIRect data encoding, 3-16
DISC, 7-7, D-5, E-7 thru E-11
Disconnect command, see DISC hdgs
Disconnected Mode Response, see DM.
DISPLAY
- field, 4-8
- MODE field, 3-18
- SIZE field, 3-18
DISPLAY DTE / DISPLAY DCE selection, 3-18
DM, 5-4, 7-7, D-5
DON'T CARE
- character, 2-3, 3-15, 3-16, 3-24, 3-25, 3-30
- key, 2-3, 3-15
DTE data, (normal video display), 3-6, 3-36

EBCD-2470 code, 3-14, 3-16, C-1
EBCDIC code, 3-14, 3-15, C-1
EFI, 7-5
ELAPSED
- SEconds or MilliSEConds selection, 3-21
- CHARacters, 3-21, 3-34
Elasped time measurments, 3-32
END statement, 4-11, 4-13
ENTER key, 2-4, 3-1, 3-12, 3-13, 4-4, 4-8, 4-11, 6-11, 7-1, 7-2
ERR CNT message, 3-6
ERROR
- ALARM field, 3-26
- COUNT field, 3-27
- 0C message, 3-28
Error
- counters, 3-26
- message, after pressing SEND, 4-9
ETX-End of Text, 1-2
EVEN parity, selecting, 3-14
Exchange Station Identification, see XID.
EXP, 7-5
EXPected value, memory self-test, 3-36
Expedited

- flow, see EXP.
- - indicator, see EFI.
EXTernal
- CLK field, 3-22, 3-26
- IN field, 3-22
- I/O jacks, 2-2
Extended
- binary-coded-decimal interchange code, see EBCDIC.
- binary-coded decimal, see EBCD.

Fast Select Acceptance, 5-6
FAST selection, 3-19
FCS field, 1-2, D-2, D-6, E-7
FI, 7-5
FID, 7-5
FID1, 7-3
FID2, 7-4
FID3, 7-4
Final bit, 3-25, 5-1, 7-6, D-3
First segment, see FS.
Flags, 5-1, E-7, D-2
- suppresing, 3-20
FLH field, 3-36
FM
- data (FMD), 7-6
- header, 7-5
Format
- identification, see FID.
- indicator, see FI.
Fox message, B-3
- trasmitting (FUNCTN F), 2-3
FRAME counter, 3-27
Frame
- check sequence, see FCS.
- formats, X.25, D-1
- number, capture buffer, 5-2, 6-2, 7-2
- reject, see FRMR.
FREEZE key, 2-2, 3-7
FRMR, 7-7, D-5, D-6
FS, 7-6
FUNCTION field
- (PAGE 3), 3-9, 3-21
- (PAGE 4), 4-8
FUNCTN key, 2-3, 4-12, 4-13
Fuse, 2-5

General format identifier, see GFI.
GFI, D-7

HDLC
- framming, D-2
- protocol, 3-13, 3-25, 5-1, B-3, E-8
Hexadecimal
- characters, entering, 3-14
- display,
- - DDCMP message, 6-2
- - SNA data, 7-3
- numbers, conventions, 1-2
HOME key, 2-4, 3-10, 5-3, 6-3, 7-3
Honeywell protocol, 3-13

I
- commands, D-6
- field, 3-24, 3-25, D-5, D-6
- frame, 5-4, 7-3 thru 7-5, D-2, D-4 thru D-7
I FIELD BITS field, 3-24, 3-25
IBM, C-2
IN: External input, 2-2
Incoming call packet, 3-23, 5-4, D-10
Incompatible Destination, 5-6, 5-8
INCOMPLETE BIU, 7-2
IND selection, 3-23
Information command, frame, or field, see I.
INITIALIZING message, 3-1, 3-35
International
- Alphabet
- - No. 2, See Baudot.
- - No. 5, see ASCII.
- Passenger Airlines Reservation System, see IPARS.
Interrupt
- confirmation packet, 5-6, D-14
- packet, D-13, D-14
INVALID
- CALL, 5-5
- LENGTH, 7-2
Inverted data sense, 3-16
IPARS
- code, 3-14, 3-15, C-2
- protocol, 3-13, 3-16

KEYCODE VALUE field, 3-36
KEYPAD/VIDEO DISPLAY, self-test, 3-36

LAP, D-1, D-4, E-10, E-11
LAPB, D-1, D-5, E-9, E-10
Last segment, see LS.
LCGN, 5-1, D-8 NORMal
LCN, 5-1, D-8

LEDs, front panel, 2-1
LH, 7-2, 7-5
LINE
- 0001 message, 2-4
- /DISPLAY page, 3-1
- MULTIPLEX-PAD display, 3-10
- MUX selection, 3-18
- MUX-PAD selection, 3-18
Link
- Access Procedure, see LAP and LAPB.
- address, SDLC, 7-5
- header, see LH.
LOCAL PROCEDURE ERROR, 5-7, 5-8
Logical
- channel group number, see LGCN.
- channel number, see LCN.
- unit, see LU.
Loopback, BERT test, 4-2, 4-4
LS, 7-6
LU/PU, 7-5
LU/SSCP, 7-5

M bit, D-13
Maintenance message, 6-5
MARK
- EXTernal INput selection, 3-19
- key, 2-4, 3-8 See also Underline.
Memory, testing, 3-36
MENU selection, 4-8
Message number, 6-2
Middle segment, see MS.
MIL-188 standard, 3-16
MONITOR
- field, 3-19
- selection, 3-6, 3-21
More-data identifier, see M Bit.
MS, 7-6

NAK (negative acknowledgement), 1-2
NAK message, 6-4
NC, 7-6
Network
- congestion, 5-5, 5-8
- control, see NC.
- operational, 5-8
NEXT field(s), 4-12
No parity, selecting, 3-14
Non-return-to-zero-inverting, see NRZI.
NOP (No Operation) statement, 4-13
NORMal
- data bit order, 3-16
- - sense, 3-16
- flow, see NRM.
Normal
- response mode, see NRM.
- video, displays DTE data, 3-36
NOT OBTAINABLE, 5-5
Nr, 3-25, 5-1, 7-5, D-3, D-4
NRM, 7-5, E-7
NRZI, 3-16
Ns, 3-25, 5-1, 7-5, D-3
NUMBER
- BUSY, 5-1, 5-5
- REFUSING COLLECT CONNECTION, 5-6

OA, 7-5
ODD parity, selecting, 3-14
Operand field, 4-10, B-2
OPERATION field, 4-4
OR/IND field, 3-23
Origin address field, see OA.
Out of Order, 5-5, 5-7
OUTput jack, 2-2

Packet
- header format, D-7
- level, D-7
- type identifier, 5-1, D-8, D-9, D-13
Pad character, 2-4
PAGE
- 1, 4-4
- 2, 4-4
- 3, 3-26
- 4, 4-4, 4-5
- key, 2-3, 3-2
PARITY field
- (PAGE 3), 3-14
- (PAGE 4), 4-5
Parity, selecting, 3-14
PASCNT message, 3-36
PASSIVE slide switch, 2-6
PATH ERROR, 7-2, 7-4
Path Information Unit, see PIU.
PATTERN
- counter, 3-27
- field, 4-4
- MATCH field, 3-12, 3-14, 3-20
Physical Unit, see PU.
PIU, 7-6
POLL selection, 4-8
Poll
- bit, 3-25, 5-1, D-3, D-4, D-5

- MENU page, 4-8
Polling, 4-3, 4-9
- program,
- - entering, 4-10
- - default, E-1
- - storing, 4-10
POST-TRIGger COUNT field, 3-28
PPB, 2-3, 4-1
Pre-trigger, 3-23
PRIMary data channel, 3-16
Primary station, 7-2
PRINT key, 4-5, 6-3, 7-3
Printer function, 4-2, 4-5
Printer/Poll/BERT, 4-1
PROCESSOR TIMER TEST, 3-35
Program page, B-1
PROGram selection, 4-8
PROTOCOL field, 3-13, 3-21, 6-1, 7-1
PU, 7-5

Q Bit, 5-1, D-7, D-13
Qualifier bit, see Q Bit.

Rack Mounting, 2-7
RD, 7-7
Receive
- not ready, see RNR.
- sequence count, see Nr. 7-5
RECEIVE slide switch, 2-6
Receiver ready frame, see RR.
RECV (Receive) statement, 4-12
REJ, 5-4, 5-7, 7-6, D-4, D-15
Reject Command/Response, see REJ.
REMOTE PROCEDURE ERROR, 5-5, 5-7
REP response, 6-4
Request
- disconnect, see RD.
- for status, X.25 protocol, D-4
- initialization mode, see RIM.
Request-response
- indicator, see RRI.
- header, see RH.
- portion of an SNA frame, 7-3
- unit, see RU.
RESET key, 2-3, 2-4, 2-8, 3-11, 3-35
Reset
- confirmation packet, 5-8, D-16
- hardware, 2-8; see also RESET key.
- indication packet, 5-7, D-15, D-16
- request packet, 5-7, D-15, D-16
- software (PAGE 6 selection), 2-8, 3-11
Resetting cause codes, D-15, D-17
Responding to poll, 4-3
Restart
- cause codes, D-16, D-17
- confirmation packet, 5-8, D-17
- request packet, 5-8, D-16, D-17
- indication packet, 5-8, D-16, D-17
RESYNC CHARacter, 3-16
- field, 3-14, 3-16
Retransmission of packet, D-15
REVerse data bit order, 3-16
Reverse video, 3-15, 3-36
REVISION REPORT, 3-35
RH, 7-2, 7-6
RIM, 7-7
RNR, 5-4, 5-7, 7-6, D-4, D-15
RPOA Out of Order, 5-6
RR, 5-4, 5-7, 7-6, D-4, D-14, D-15, E-7, E-8
- packet, triggering on, 3-25
RRI, 7-6
RS-232-C, 4-11, D-1
RU, 7-6
RUN key, 2-2, 3-1, 3-8, 6-3psblOH
Run mode, 2-3, 2-4, 3-6, 6-1, 6-3, 7-1

S Frame, 5-4, 7-4, 7-6, D-2, D-6
SABM, 5-4, D-5, E-10
SARM, 5-4, D-4, E-11, E-12
SAVE USER PROGRAM, 4-10
SAVE/RECALL menu, 4-10
SBT code, 3-14, 3-15, C-2
SC, 7-6
Scratch pad, 3-36
Scroll keys, 2-4, 3-4, 3-8, 3-12, 5-3, 6-2, 7-3
Scrolling,
- automatic, 3-10, 6-2, 7-3
- step, 3-10
SDI, 7-6
SDLC protocol, 3-13, 7-1, E-7
Secondary
- data channel, monitoring, 3-16
- station, 7-2
SEG, 7-6
Segmentation mapping field, see SEG.
Selectable fields, 3-12, 3-13
SELECTION field, 4-8
SELECTRIC code, 3-14, 3-16, C-2
Self-test mode, 2-4, 3-35
SEND key, 2-3, 4-4, 4-9, 4-11, B-1

Send sequence count, see Ns.
Sense data included indicator, see SDI.
SENSE field, 3-16
Sequence number field, see SN.
Session control, see NC.
Set
- asynchronous response mode, see SARM.
- asynchronous balanced mode, see SABM.
- initialization mode (SIM), 7-7
Setup page, see PAGE 1 or Line/Display Configuration.
Shift characters (Baudot), C-1
SHIFT key, 2-3, 5-2, 6-2, 7-3
SIM DCE or SIM DTE
- rotary switch, 4-2, 4-5
- selection (PAGE 4), 4-8
SIM, 7-7
Six-bit transcode, see SBT.
SN, 7-6
SNA protocol, 7-1
SNRM, 7-7, E-7
Software reset, see Reset.
Special symbols, see Fox Message, Character Set, and Don't Care.
SPR (LED), 2-2
SS-LU, 7-5
STACK message, 6-4
START
- message, 6-4
- STRING selection, 3-24
- STRINGS field, 3-22, 3-23
Start trigger, 2-2, 3-21, 3-22
STOP
- ON ERROR field, 3-27
- STRINGS field, 3-23, 3-24
Stop trigger, 2-2, 3-8, 3-21, 3-26, 7-1
Supervisory frames, see S Frames.
SUPPRESS
- CHARacters field, 3-12, 3-14, 3-20
- TEXT field, 3-19, B-1
Switch, rotary, front panel, 2-2
SYNC
- CHARacters, 3-7, 3-15, 3-20
- - field, 3-14, 3-15
- - suppressing, 3-20, 6-1
- - IPARS, E-5
- protocol, 2-3, 3-7, 3-13 thru 3-15, 3-23, 4-4
SYSTEM RAM self-test, 3-36
System Service Control Point indicator, see SSCP.

TEST, 7-7
Th, 7-2, 7-6
TIME MUX selection, 3-18
Time-multiplex display mode, 2-4, 3-7
TIMEOUT
- counter, 3-27
- VALUE field, 3-32, 3-28
Timeout-stop function, 3-21, 3-32
TOUT (Time Out) statement, 4-13
Transmission
- Code
- - character sets, 3-36
- - tables of, C-1
- - selecting, 3-14
- - - while running, 3-8
- header, see TH.
TRANSMIT slide switch, 2-6
Transmitter sequence count, see Ns.
TRANSP SYNC key, 2-3, 3-7
TRIGGER COUNT field, 3-28, 4-4
Trigger Strings, 3-24
TURN AROUND key, 2-4, 3-7, 3-18
Turnaround time, 2-4

U frame, 5-4, 7-4, 7-7, D-2, D-6
UA response, 5-4, 7-7, D-4, D-5, E-7, E-8, E-10 thru E-12
UI, 7-7
UNDEFINED code, 3-14, 3-16
Underline, blinking, 2-4, 3-8, 3-19, 3-20, 3-23
Unnumbered
- acknowledge, see UA.
- frames, see U Frames.
- information frame, see UI.
- poll frame, see UP.
Unsequenced Frames, see U Frame.
UP, 7-7

VIDEO RAM, self-test, 3-36
Virtual call, D-7
VRC/LRC, selecting, 3-14

WRITE/READ RAM LOOP, self-test, 3-36

X in dim reverse video, see "Don't Care" Character.
X.25 protocol, 3-33, 5-1, D-1
XID, 7-7
XMIT (Transmit) statement, 4-12

# WARRANTY

*Products manufactured by CXR Telcom Corporation are guaranteed to be free of defects in materials and workmanship for a period of two years from the date of shipment. CXR Telcom will accept returned items, transportation prepaid to the service center, for repair during the warranty period at no cost to the customer, provided that the products have not been subjected to improper installation, accident, misuse, neglect, or unauthorized alterations.*

**Certification**

CXR Telcom Corporation certifies that all instruments are thoroughly tested and inspected and found to meet published specifications when shipped from the factory.

**Inspection**

All products manufactured by CXR Telcom are carefully inspected and thoroughly tested prior to shipment. Modern packaging techniques are used to prevent damage during shipment. If goods are received in a damaged condition, A CLAIM SHOULD BE FILED WITH THE TERMINATING CARRIER IMMEDIATELY. Normally, the carrier will want to inspect the shipping carton and packing materials.

**Repair Service**

If equipment does not operate properly when tested in accordance with the instructions, it should be returned to an authorized service center for repair. **Call or write Customer Service for a Return Material Authorization prior to shipping any equipment to the factory.** When returning equipment for repair, utmost care should be taken to avoid shipping damage. If available, use the original cartons and packing material. Shipping charges should be prepaid.

If the equipment is covered by warranty, it will be repaired free of charge or replaced, at the Company's option, and returned prepaid. Unauthorized field repairs or modifications will invalidate the warranty.

For out-of-warranty repair work, Customer Service will provide a quotation for repair charges first, unless the shipment is accompanied by a purchase order. Repair work will be performed after authorization to proceed (in the form of a purchase order) is received.

**Service Centers**

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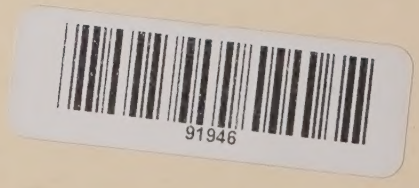


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